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YEARBOOK

OF THE

UNITED STATES DEPARTMENT OF AGRICULTURE.

1908

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[CHAPTER 23, Stat. at L., 1895.]

[AN ACT Providing for the public printing and binding and the distribution of public documents.]

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Section 73, paragraph 2:

The Annual Report of the Secretary of Agriculture shall hereafter be submitted and printed in two parts, as follows: Part One, which shall contain purely business and executive matter which it is necessary for the Secretary to submit to the President and Congress; Part Two, which shall contain such reports from the different Bureaus and Divisions, and such papers prepared by their special agents, accompanied by suitable illustrations, as shall, in the opinion of the Secretary, be specially suited to interest and instruct the farmers of the country, and to include a general report of the operations of the Department for their information. There shall be printed of Part One, one thousand copies for the Senate, two thousand copies for the House, and three thousand copies for the Department of Agriculture; and of Part Two, one hundred and ten thousand copies for the use of the Senate, three hundred and sixty thousand copies for the use of the House of Representatives, and thirty thousand copies for the use of the Department of Agriculture, the illustrations for the same to be executed under the supervision of the Public Printer, in accordance with directions of the Joint Committee on Printing, said illustrations to be subject to the approval of the Secretary of Agriculture; and the title of each of the said parts shall be such as to show that such part is complete in itself.

PREFACE.

The Yearbook issued by the U. S. Department of Agriculture is the most important publication of the Department. Its scope is wide and its character general, while nearly all other publications of the Department are limited in scope and special in character. In the Yearbook the aim is to bring together and present in brief popular style the best information available on agriculture and subjects related thereto.

The general plan underlying the preparation of the Yearbook contemplates: (1) A general review of the work of the Department and the progress of agriculture during the preceding fiscal year, this feature consisting of the Annual Report of the Secretary; (2) a series of papers on carefully selected subjects prepared by competent scientists and experts employed in all the main branches of the Department; (3) an Appendix setting forth the organization of the Department, up-to-date information concerning the State experiment stations and agricultural colleges, State officials for agriculture, and all the principal societies and associations for the promotion of agricultural interests, a review of events and progress along several important lines embraced in the sphere of departmental activity and observation, and agricultural statistics covering a wide range.

The plan outlined above was strictly adhered to in the preparation of the present volume. The report of the Secretary, occupying 186 pages, is somewhat longer than usual, owing in part to the rapid growth of the Department and the extension of its activities and in part to a brief review of progress during the past twelve years.

There are twenty-three popular papers, occupying 304 pages. Some of these describe agricultural conditions and manufacturing processes involved in the working up of agricultural products; others are distinctly practical, outlining the means and methods to be employed in agricultural production; still others give first reports on Departmental investigations, which are of special interest to investigators and scientific students.

The Appendix, occupying 294 pages, contains the usual directory and review features. In the portion devoted to agricultural statistics there are included a number of new features. After much research a statement of the production and trade in tobacco from the earliest

colonial times has been compiled, so that now the progress of two leading crops of the United States—cotton and tobacco—may be traced statistically from the beginning of their commercial importance. The table for cotton was published two years ago and is reprinted with the addition of the most recent data. The progress of our foreign trade in the leading farm and forest products for nearly sixty years can be readily traced by means of the tables of exports and imports of such products since 1851, and from the five-year averages given in these tables the general trend can be followed without the interruption caused by the statistics of any exceptional year. The usual statements of acreage, production, and farm prices of various crops are now more valuable on account of the averages which are given for each geographic division. The relative importance of the United States in the world's agriculture is shown by an increasing number of tables. Among those compiled within the last few years are tables showing the number of farm animals in different countries, the world's production of cotton, wool, rice, tobacco, potatoes, and hops, and for more than a score of commodities the quantities exported and imported by practically all the countries of the world. All statistics in the Appendix are either gathered by the Department itself or compiled from the original authorities. They are therefore the best to be had.

Believing that suitable illustrations are of great value not only in making the volume attractive, but in supplementing, elucidating, and enforcing the text matter, the Editor and others engaged in preparing the present volume have given much careful attention to this feature. In all there are eighty-four illustrations, of which twenty-nine are text figures and fifty-five are full-page plates, thirteen of the latter being colored.

JOS. A. ARNOLD,
Department Editor.

WASHINGTON, D. C., *July 12, 1909.*

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YEARBOOK

OF THE

U. S. DEPARTMENT OF AGRICULTURE.

REPORT OF THE SECRETARY.

MR. PRESIDENT:

I respectfully present my Twelfth Annual Report, covering the work of the Department of Agriculture for the year 1908.

The crops of the year and the other products of the farm first claim attention, after which the work of the Bureaus and other offices of the Department, in and outside of Washington, is summarized. Then follows a review of the progress of agriculture in this country during the last twelve years, with concise statements of the principal causes and the more prominent results.

AGRICULTURAL PRODUCTION IN 1908.

TOTAL VALUE.

Billions upon billions the farmer has again piled his wealth. Production has been above the average of recent years all along the line, with few exceptions, and some prices have been up while others were down. After offsetting losses against gains, in comparison with 1907, there remains a net gain which raises the total value of all farm products of 1908 to the most extraordinary amount in the world's history, $7,778,000,000.

This value is the result of estimates for all products itemized by the census and is based upon the census plan of valuation. While it includes some duplication, on the other hand it does not include some important items of wealth production, and the fact remains that the unthinkable amount of 7¾ billions of dollars of wealth have been produced by farmers this year for national sustenance and for export to the craving millions of foreign nations.

It is real, tangible wealth as it exists at the time it leaves the hands of the producer. It is about four times the value of the products of the mines, including mineral oil and precious metals. From these agricultural products the manufacturing and mechanical industries that use agricultural products as materials draw 86.8 per cent of

their total materials, and these industries use 42 per cent of all materials used in the entire business of manufacturing. These figures indicate the extent to which the manufacturing industries are indebted to agriculture, although no recognition is given to this fact in usual statements of the value of manufactures.

INCREASE ABOVE FORMER YEARS.

The farm value of farm products this year is $290,000,000 above the value for 1907, $1,023,000,000 above that of 1906, $1,469,000,000 above that of 1905, $1,619,000,000 above that of 1904, $1,861,000,000 above that of 1903, and $3,061,000,000 above the census amount of 1899.

Expressed in the form of percentages of increase, the amount for 1908 was 4 per cent greater than that for 1907, 15 per cent over that for 1906, 23 per cent over that for 1905, 26 per cent over that for 1904, 31 per cent over that for 1903, and 65 per cent over that for the census year 1899.

A simple series of index numbers shows the progressive movement of wealth production by the farmer in another form. The value of products in 1899, the census year, being taken at 100, the value for 1903 stands at 125, for 1904 at 131, for 1905 at 134, for 1906 at 143, for 1907 at 159, and for 1908 at 165.

During the last ten years the wealth production on the farms of this country has exceeded the fabulous amount of $60,000,000,000.

CHIEF CROPS.

In the statement that follows concerning the crop quantities and values for 1908 no figures should be accepted as anticipating the final estimates of this Department to be made later. Only approximations can be adopted, such as could be made by any competent person outside of this Department.

CORN.

Greatest of all crops is Indian corn, the priceless gift of the Indian, who freely gave to the white man information which led to the production of 2,643,000,000 bushels this year. The crops of three years have exceeded this, but only the crop of one year—1906—exceeded it very much.

The value of this crop almost surpasses belief. It is $1,615,000,000. This wealth that has grown out of the soil in four months of rain and sunshine, and some drought, too, is enough to cancel the interest-bearing debt of the United States and to pay for the Panama Canal and 50 battle ships.

The price of corn is exceptionally high. There are only two years in the records of this Department in which the farm price of this

crop was as high as it is for this year. In 1881 the price was 63.6 cents; in 1901, when there was only two-thirds of an ordinary crop, the price was 60.5 cents.

The total value of this crop is by far the highest ever reached. The crop of 1902 was worth a billion dollars, and the crops of 1904, 1905, and 1906 were worth $100,000,000 more; the great increase of $300,000,000 over the crop of 1902 was made in 1907, and now the increase is $600,000,000, equal to the gold in the treasury of a rich nation.

The corn crop far exceeds in value the prominent farm crops next below. It is worth nearly as much this year as the great crops of cotton, hay, and wheat combined.

In comparison with the averages of the preceding five years, the quantity of the corn crop of this year is 2.1 per cent higher and the value 42.6 per cent higher.

COTTON.

Commercial interests have agreed upon a large cotton crop for 1908–9, and, accepting their opinion for the moment, it seems likely that the crop stands with the highest three years in quantity. In value, however, it is apparently next to the highest, and perhaps equal to that, although the farm price of cotton this year is below the price of last year by more than 1 cent.

The average cotton crop of the preceding five years is considerably exceeded by the crop of this year, yet the value this year is hardly above the five-year average.

For the first time in the history of this country's agriculture the value of the cotton crop, including the seed, has apparently exceeded the value of the hay crop, which has heretofore held second place for a long series of years.

HAY.

The reason the value of the hay crop has lost its relative place in the scale of crop values is that the price is low because of high production. The price this year at the farm is more than $2 per ton less than it was a year ago; so that, although the number of tons harvested this year was 68,000,000, or 11.7 per cent above the average of the preceding five years, the total value is but $621,000,000, or only 5.7 per cent above the five-year average. Otherwise compared, the hay crop is the largest ever produced in this country, and its total value has been exceeded but once.

WHEAT.

Wheat is 1.5 per cent above the five-year average in production and 23.3 per cent above that average in total value. The story would have been somewhat different had this country depended upon spring

wheat alone, since that crop suffered considerably because of the drought.

In quantity the wheat crop is 660,000,000 bushels and has been often exceeded, while the value is $620,000,000, and was never equaled, nor approached nearer than $66,000,000.

OATS.

The fifth crop in value is oats, with a total of $321,000,000, or 9.6 per cent above the five-year average. The quantity, however, was 9.3 per cent below the five-year average, and was represented by 789,-000,000 bushels, the low amount being due to protracted drought. In only one year, 1907, has the total value of the oat crop exceeded the value this year, but the quantity has often been exceeded.

BARLEY.

The cereal crop next below oats in value is barley, with a production of 167,000,000 bushels, worth $86,000,000 at the farm. The number of bushels and their value have been exceeded only once, but in a comparison with the averages of the preceding five years the production is higher by 13 per cent and the total value by 22.6 per cent.

RYE.

Rye is a crop that has remained steady at a production of about 30,000,000 bushels or a little more in recent years, and the crop of this year is higher in comparison with the five-year average by only 3 per cent, although the total value is higher by 17 per cent. This value is about $22,000,000, which has been exceeded three times.

RICE.

The large rice crop of this year, 23,000,000 bushels, gives it a value close to that of the rye crop, or about $18,000,000. This is 28.7 per cent above the average of the preceding five years in quantity and 22.7 per cent above it in value.

No year has produced such a rice crop as this one in quantity, nor has the rice crop of any former year been worth as much to the producer.

ALL CEREALS.

When buckwheat is added to the cereals above mentioned, interesting totals are provided. While all of these cereals are measured by the bushel, they are not fully comparable one with another on this basis; but, after all, in the grand aggregate of bushels of cereals there is some indication of comparative production, one year with another.

The total quantities of cereals produced in this country this year is 4,329,000,000 bushels, an amount that has been exceeded three times.

The value of all cereals reaches the grand total of $2,694,000,000, an amount that is more than $300,000,000 above that of last year, and still greater than in former years.

In the five-year comparison, the number of bushels of cereals this year is higher by 0.2 per cent, and the value is higher by 32 per cent.

POTATOES.

On account of the unfavorable weather, the potato crop of this year is low in quantity, 275,000,000 bushels, being 5.1 per cent below the five-year average and having often been exceeded by crops of former years. In value, however, $190,000,000, this crop is 18.1 per cent above the five-year average and was never equaled in any other year.

SUGAR BEETS AND CANE.

In the production of sugar beets for sugar making, this year stands at the top, both in quantity and in its value to the farmer, although in both respects not much above the figures for 1906 and 1907; but, in comparison with the average of the preceding five years, the tonnage of this year is higher by 44.7 per cent and the value, $21,500,000, by 43.7 per cent.

The plantation value of sugar cane, molasses, and sirup for 1908 is estimated to be about $34,000,000, a value which was exceeded only in 1904, but in comparison with the five-year average the value is greater this year by 9.7 per cent.

The foregoing figures relate to raw materials of sugar, but it is always interesting to notice the estimates of the values of the finished product, or refined sugar for beets and raw sugar for cane.

The beet-sugar production from the crop of 1908 reaches a higher figure than ever before, or about 500,000 short tons, worth at the factory, with the pulp, about $45,000,000; this value also is higher than for any preceding year.

In the case of the raw sugar of cane, the production of 1908 has a commercial estimate of about 407,000 short tons, a quantity perceptibly greater than the high figures of four or five former years. The value of this product has been exceeded in only one year, 1904.

The value of the sugar beet and of the sugar cane to the grower, with the addition of such molasses and sirup as are made on the farm and outside of factories, makes a total of about $56,000,000 for 1908.

On combining beet sugar with cane sugar, the total production of 1908 is estimated to be about 900,000 short tons, an amount much above the total of the highest former year; th efactory value of the

two kinds of sugar is supposed to be $75,000,000, and this holds the record place.

The grand total value of the refined sugar of beets, of the raw sugar of cane, of beet pulp, of molasses and sirup of cane and sorghum, and of maple sugar and sirup, resulting mostly from commercial estimates, is $94,000,000 for 1908.

TOBACCO.

Tobacco production has been low for several years on account of a depression in price, but the price rose considerably in 1907 and is perhaps still higher this year. Apparently the value of the tobacco crop to the farmer this year is at least $70,000,000, or about the value of 1907, and much higher than in preceding years.

While the crop is under the five-year average in quantity, its value is over 15 per cent higher.

HOPS.

The extremely low price of hops in 1907 caused a great reduction in the acreage of 1908, with the result that the commercial estimate of the crop is 39,000,000 pounds, the value of which is about $4,000,000, both amounts being exceeded in many former years.

In comparison with the preceding five years, the quantity of the hop crop is lower by 27.6 per cent and the value by 42.9 per cent.

ALL FARM CROPS.

For the first time, the value of all farm crops this year equals $5,000,000,000, and of this total the value of the corn crop is about one-third; wheat, hay, and cotton combined make more than one-third; and the smaller crops the remainder, or nearly one-third.

The crop production for the year is on the whole a high one. Never before was the hay crop so large in quantity, nor the rice crop, nor the sugar-beet crop, nor beet and cane sugar production. The production of barley has been exceeded in only one former year, and cotton has been exceeded by only two years at the most.

With regard to crop values, this year leads all former years in the case of corn, wheat, rice, all cereals, potatoes, sugar beets, beet sugar, beet and cane sugar combined, and possibly tobacco.

Next to the highest value, in comparison with former years, was reached by cotton, hay, barley, oats, sugar cane, and cane sugar.

In comparison with the preceding five years, crop production has been higher for every crop mentioned above except oats, flaxseed, potatoes, tobacco, and hops; values were higher than the average of the preceding five years for every crop except cotton seed and hops.

Notwithstanding two or three rather alarming periods of drought during the growing season, after all, the crop production of the year stands high, although not extraordinarily so, and the level of values is high.

ANIMAL PRODUCTS.

To the farmer who has averaged hardly 20 cents a pound for the butter that he has sold, between 3 and 4 cents a quart for his milk, and about 1½ cents for each egg, and even to the consumer who has paid prices much above these, it is a striking fact that the value of the farm products of the dairy cow are getting closer and closer to $800,000,000, and that the eggs and poultry produced on the farm are worth as much as the cotton crop, seed included, or the hay crop, or the wheat crop.

These advances in value are not due solely to increase in number of cows and of poultry, but considerably also to advances in price. The mean factory price of Elgin butter was 19.66 cents in 1899, 28.5 cents in 1907, and 27.16 cents in 1908. The mean farm price of eggs throughout the United States was 11.15 cents in 1899, 17.02 cents in 1904, and 18.3 cents in 1908. The wholesale milk prices at Chicago and New York, respectively, were 10.5 and 10.12 cents per gallon in 1899, 12.24 and 11.76 cents in 1905, 14.375 and 12.886 cents in 1907, and 15.16 and 16.62 cents in 1908.

The mean wholesale price of dressed poultry in New York was 11.15 cents per pound in 1899, 12.97 cents in 1903, 14.9 cents in 1907, and 13.56 cents in 1908.

The aggregate value of animals sold and slaughtered increases year by year because of increasing number and also because of a rising price level, although in the case of some classes of animals prices fall at times.

In the aggregate the value of animals sold and slaughtered and of animal products at the farm amounts to about three-eighths of the value of all farm products, estimated upon the census basis. This value is getting closer and closer to $3,000,000,000.

FOREIGN TRADE IN AGRICULTURAL PRODUCTS.

EXPORTS.

Never before in the foreign trade of this country have the exports of domestic agricultural products been as valuable as they were in the fiscal year ending June 30, 1907, but the amount was only $37,000,000 below that amount in 1908, when the value of these exports was $1,017,000,000, or greater than for any year except 1907.

The falling off in exports in 1908 was due mostly to cotton, which showed a decrease of $43,000,000, a loss which was partially offset by an increase of $31,000,000 in exports of grain and grain products.

By far the largest item or group of agricultural exports was cotton, with a value of $438,000,000; next, grain and grain products, $215,000,000; and, third, packing-house products, valued at $196,000,000.

IMPORTS.

The loss in imports of agricultural products in 1908, compared with 1907, was $87,000,000, or much more than the loss of exports, the principal item of decrease being packing-house products; on the other hand, there were increases, chief among which were fruits and vegetables.

The principal items of import in 1908 were silk, $65,000,000; wool, $24,000,000; packing-house products, such as hides, etc., $66,000,000; coffee, $68,000,000; various vegetable fibers, $50,000,000; fruits, $28,000,000; vegetable oils, $16,000,000; sugar and molasses, $81,000,000; tea, $16,000,000; and tobacco, $23,000,000.

The total imports of agricultural products in 1908 were valued at $540,000,000 in the countries from which they were exported, a decrease of $87,000,000 from the amount of 1907.

TRADE IN FOREST PRODUCTS.

A decrease of $2,600,000 was the result of the export trade of this country in forest products of domestic production in 1908 as compared with 1907, due mostly to a decrease in value of exports of lumber and, in a less degree, of timber.

There was a diminution also in the value of imports of forest products in 1908 compared with 1907, the loss being $24,000,000, found almost entirely in india rubber. There was a gain of $2,000,000, however, in the value of pulp wood and of $1,000,000 in wood pulp.

COMPARISON OF CLASSES OF EXPORTS.

On account of the sudden expansion of exports of manufactured products during the fiscal year 1908 the fraction of the value representing agricultural products and commodities whose manufacture is sustained mainly by agricultural materials declined somewhat in comparison with recent years and is now 61.5 per cent, while the fraction for forest products and for commodities whose manufacture is mostly sustained by forest products as materials is 7.8, and the fraction for exports that are not agricultural, nor of forest origin, either fully or in principal degree, is 30.7.

Animals and animal products contributed 16 per cent to the value of the total exports of 1908; cotton and cotton products, 26.9 per cent; grain and grain products, 12.2 per cent; all other products chiefly sustained by agriculture, 6.4 per cent.

BALANCE OF TRADE.

The exports of domestic farm products in 1908 being worth $1,017,000,000, the exports of foreign products being over $10,000,000, and the imports of farm products being $540,000,000, a balance of international trade in favor of the farm products of this country results, with the enormous value of $488,000,000.

During the same period the balance of trade in products other than those of the farm was $178,000,000, or an amount that has not been equaled within the memory of man. The agricultural balance was exceptionally high and has been equaled only in 1901 and 1898. The magnificent figures of the farmers' contribution to the exports of this country and to the favorable balance of trade are maintained in spite of this country's immense growth in population and extraordinary immigration of nonagricultural peoples, and also in spite of the diminishing fraction of the population that is engaged in agriculture. No analysis could more strongly indicate the progressive efficiency of the farmer's labor and capital and the telling effects of the agricultural sciences.

FOREIGN TRADE OF MORE THAN HALF A CENTURY.

AGRICULTURAL EXPORTS AND IMPORTS.

A compilation of the foreign trade of the United States in agricultural and forest products has just been completed as far back as the fiscal year 1851, and for the first time the general results are here made public. Annual averages by five-year periods are used for better understanding.

In 1851–1855 the exported agricultural products of domestic origin were valued at $150,000,000, and in the five years just before the civil war at $229,000,000. After that war the amount steadily grew by five-year periods to the great value of $875,000,000 in 1901–1905 and afterwards to $1,054,000,000 in 1907, the highest year of all.

The exports of agricultural products of foreign origin increased from $8,000,000, the annual average for 1851–1855, to $12,000,000 in 1901–1905, an amount that was not equaled in subsequent years.

The value of the imports of agricultural products at the beginning of the period under review was $68,000,000, as the annual average for 1851–1855. The average was progressive to the last period, with the exception of two five-year periods, and for the five years 1901–1905 it averaged $455,000,000. The highest amount ever reached was $627,000,000 in 1907.

Upon striking a balance of trade the evidence of the most remarkable power of the farmers of this country to produce a national surplus is brought out forcibly. For the first period, 1851–1855, the

annual average balance in agricultural products in favor of this country was $89,000,000; the civil war diminished this, but the rise afterwards was fairly steady but firm until the period of 1896–1900, when there was a quick increase in the balance to $387,000,000, after which the amount has been always more than $400,000,000, except in 1905, and in 1901 it was $571,000,000, the highest amount in history.

During the entire period until 1898 the farmer provided this country with a balance of trade in his own products which offset a part or all of the unfavorable balance in the international exchange of commodities other than agricultural. After struggling with the load for a quarter of a century, he was able to overcome the adverse balance in commodities other than his own in 1876, when he began to produce a favorable balance of trade in the total of all commodities, steadily, year after year, with the exceptions of 1888, 1889, and 1893.

The per capita values of the exports of agricultural products expressed in annual averages by five years show that they have more than doubled during the half century under review. The per capita value during the period 1851–1855 was $5.84, and this average grew with several irregularities to $10.88 for 1901–1905 and to $12.29 for 1907, the highest amount of record.

On the other hand, the per capita value of the imports of agricultural products increased from $2.67 for 1851–1855 to $6.25 for 1871–1875, an amount that was not equaled by any subsequent five-year average. The average for 1907 was $7.30, which was higher by $1.05 than the great annual average for 1871–1875.

FOREST PRODUCTS.

The value of the exported forest products of domestic origin has steadily increased during the fifty-eight years under review. Beginning with an annual average of $6,000,000 in 1851–1855, these exports steadily increased in value to $28,000,000 in 1891–1895, after which the rise was rapid to $59,000,000 in 1901–1905, and to $93,000,000 in 1907, which was nearly equaled in 1908.

The per capita average of these export values was 24 cents in 1851–1855 and $1.08 in 1907.

Imports also of forest products have enormously increased in value during the fifty-eight years. They were valued at $2,000,000 as the average for 1851–1855, at $72,000,000 for 1901–1905, at $122,000,000 for 1907, by far the highest amount, and the value for 1908, $98,000,000, was next high.

The per capita value of those imports was 8 cents for 1851–1855 and $1.43 for 1907.

Rosin has increased in quantity of exports from the beginning to the end of the fifty-eight-year period, the number of barrels ex-

ported annually in 1851–1855 being 525,000, the number in 1901–1905 being 2,530,000, and in 1908, 2,713,000.

The exports of spirits of turpentine increased in a much greater degree than the foregoing, or from 1,000,000 gallons in 1851–1855 to 18,000,000 gallons for the ten years 1896–1905, after which there was a reduction to 16,000,000 gallons, but the greatest exports for any year were nearly 20,000,000 gallons in 1908.

Wood pulp has declined steadily in exports, the average for 1896–1900 being 45,000,000 pounds. It was 35,000,000 pounds in 1901–1905, 29,000,000 pounds in 1906, 25,000,000 pounds in 1907, and 24,000,000 pounds in 1908.

Imports of various items of forest products gain interest in a review for as long a period of time as fifty-eight years. Imported wood pulp averaged 42,000 tons in 1891–1895, and the gain was steady to 213,000 tons in 1907, and to 238,000 tons in 1908.

The pounds of imported india rubber rose from 38,000,000, the average for 1891–1895, to 77,000,000 in 1907, which was not equaled in 1908.

Imported cabinet woods increased steadily from an average of $515,000 in 1851–1855, to $5,000,000 in 1907, and the imports of timber and lumber other than cabinet woods were multiplied six times in value from 1856–1860 to the present time.

The farmer had many reasons for his Thanksgiving in 1908, as he had in recent former years. He has reaped as well as sowed. He has obtained more of the means with which to improve his farm, to increase his capital, to become a more generous consumer of the goods of other producers, and to add to the things that count for a better living and a more pleasant life.

THE DEPARTMENT'S WORK IN 1908.

LEGAL OPERATIONS.

Owing to the Department's duties in the enforcement of the food and drugs act, the new meat-inspection law, and the amended twenty-eight-hour law, together with the increasing scope and complexity of the Department's operations, the Office of the Solicitor has within the last two years assumed greatly increased importance.

In all cases in which punishment for violation of law is sought the course of procedure is for the Solicitor to prepare a statement of the case for transmission by the Secretary of Agriculture to the Attorney-General. The prosecutions are begun and carried on by the United States attorneys in the various judicial districts. In many cases, however, the Solicitor has examined authorities, prepared briefs, and assisted in adducing evidence.

ENFORCEMENT OF THE TWENTY-EIGHT-HOUR LAW.

During the year a very large number of cases have been brought, at the instigation of this Department, against various railway companies for violations of the twenty-eight-hour law, which limits the number of hours during which a shipment of live stock may be kept in cars without unloading. In 401 of these cases penalties were imposed amounting in all to $61,530, and costs were assessed amounting to $7,201.70, and 828 cases were pending at the close of the year.

OFFENSES AGAINST QUARANTINE LAWS.

For the failure to properly placard cars containing shipments of southern cattle from below the quarantine line, 33 cases were reported to the Attorney-General, and favorable decisions in 25 of these cases resulted in penalties aggregating $2,400 and costs amounting to $123.83. Fines of $100 and costs were imposed in each of 4 cases against individuals for illegally removing southern cattle out of the quarantine area. For infractions of the law for the suppression of contagious diseases of animals, 8 cases were reported to the Attorney-General, the offense in each case consisting in the illegal shipment of sheep infected with scabies.

ENFORCEMENT OF FOOD AND DRUGS ACT.

At the beginning of the year no case had been brought for violation of the food and drugs act of June 30, 1906, although the machinery for the enforcement of the act had been created. During the year, however, 135 cases were reported to the Attorney-General, 97 of these being for criminal prosecution and 38 for seizure and condemnation. Of the criminal cases, 14 have resulted in convictions, the fines ranging from $5 to $700 with costs. Of the 38 seizure and condemnation cases, 14 resulted in forfeiture and condemnation. So far not a single case has been decided adversely to the Government.

The Solicitor has devoted much time and attention to the work of the Board of Food and Drug Inspection, of which he is a member. The consideration of questions submitted to the board for determination and the preparation of "Food Inspection Decisions" for the instruction and guidance of those who desire to conduct their business in strict conformity with this law have occupied much time and have been of far-reaching importance in securing compliance with the provisions of this act. Twenty-three of these decisions were prepared and published during the year. One of these (F. I. D. No. 86, "Original Packages"), prepared by the Solicitor, covered the relation of the original package to interstate commerce, and its preparation involved a careful review of all the leading Federal cases on the subject

of interstate commerce. This decision has met with a most favorable reception by the legal profession and has been of great value to United States attorneys in handling cases under this act.

VIOLATION OF GAME LAWS.

Under the Lacey Act governing interstate shipment of game, 7 cases were reported to the Attorney-General for prosecution; also 4 cases for the unlawful killing of game in Yellowstone Park. Two of these cases were decided in favor of the Government and others are pending.

MISCELLANEOUS CASES.

The Solicitor gave attention to four cases in the Court of Claims in which the Department was interested. He submitted the evidence used in securing conviction of a former employee of the Department for inserting false and fraudulent items in his expense account, the guilty party receiving a sentence of $1,000 fine and thirty days in jail. In several cases employees of the Bureau of Animal Industry engaged in meat inspection and field work have been assaulted and roughly handled while in the proper performance of duty. In all such cases it is the policy of the Department to vigorously defend its agents, and to use every effort to secure punishment of such offenders. In one case during the past year a ranchman in Wyoming was fined $500 and given three months in jail for brutally assaulting an inspector who refused to falsely certify that the offender's cattle had been dipped. For an attack on an agent engaged in tick-eradication work in Tennessee two offenders were fined $150 each. For an assault on a meat inspector in Indiana the guilty parties were fined $100 each.

LEGAL PAPERS—PUBLICATIONS.

The preparation and examination of legal papers—bonds, contracts, leases, etc.—occupy an important place among the duties of the Solicitor. The contracts receiving attention during the past year numbered 374 and the leases 377.

A compilation of the laws affecting the Department of Agriculture, made in the office of the Solicitor and published with an exhaustive index, has proved extremely useful to officers of the Department. A series of circulars has been started and seven numbers issued, containing reports of judicial decisions in cases involving the twenty-eight-hour law. The object in publishing these circulars was to make these decisions immediately available for the use of United States attorneys handling cases against alleged violators of this law. The value of these circulars has been abundantly demonstrated.

OFFICERS AND EMPLOYEES.

On July 1, 1908, as shown by the report of the Appointment Clerk, there were on the rolls of the Department 10,420 persons, 2,488 employed in Washington and 7,932 outside of Washington. The net increase in the Department force during the year was 1,313. The total number of appointments was 17,819. Of these 15,991 were to temporary or emergency positions, chiefly in the grade of laborer, continuing in most cases not more than three months and in many cases not more than one month, the great majority to positions outside of Washington. Resignations numbered 574, deaths 41, removals for misconduct 41, and separations from the unclassified service 31, while 128 persons declined to accept appointments. By far the largest increase, 741, is in the Forest Service. Positions on the statutory roll (those prescribed by the appropriation act) number 1,161, while 9,259 are on the lump-sum roll. More than 2,600 members of the Department may properly be classed as scientists. Contingencies arising in the Department's field work—demonstration farming, meat inspection, food inspection, protection of the National Forests from trespass and from fire, cattle-tick eradication, moth eradication, and insect fighting—account largely for the temporary appointments.

NEW BUILDING OPERATIONS.

The new Department building was completed during the year. While the contract date for the completion of the general construction work was November 29, 1907, the work was not finished until four months after that date. On March 17, 1908, the building was accepted subject to the completion of several minor items of unfinished work, and steps were immediately taken toward its occupancy by the various Bureaus of the Department, which were very inadequately housed in scattered buildings rented by the Department. All of the general construction and mechanical equipment work has been satisfactorily completed, and final payments have been made thereon. Since July 1, 1908, contracts have been let for an additional boiler, for mechanical stokers, and for vacuum cleaning machinery for the new building. The boiler has been completely installed, as have the stokers, which permit the use of bituminous coal without smoke, at a much less cost than anthracite coal. The vacuum cleaning machinery is now being installed.

The Building Committee of the Department has been dissolved, but has been succeeded by a Committee on Buildings, whose attention is being devoted not only to the new building but to the old quarters as well. Several structures in close proximity to the new building have been or will be removed, in accordance with the provisions of the

original plan and appropriation for the building work. In carrying out this plan new quarters for shops, stables, and storage are being erected on the north side of the Department grounds, for which purpose a special sum was appropriated by Congress at its last session.

WEATHER BUREAU.

FORECASTS AND WARNINGS.

A few years ago the Department undertook to establish a research station at Mount Weather, Va., for the investigation of the problems of the air. This institution was planned to meet the highest requirements of science, and at the same time had as an object the acquirement of additional knowledge bearing directly on the forecasting of the weather. Heretofore the forecasts made by the Weather Bureau have been based entirely on the conditions of the air as observed at the surface of the earth, but for seevral years the Mount Weather station has been sending meteorological instruments into the upper levels of the atmosphere to find out what is going on there, and to obtain, if possible, additional information for the use of the weather forecasters at Washington in making their predictions. This object is now being realized, and the securing of data every day at altitudes of from 1 to more than 4 miles marks an important epoch in the work of the Weather Bureau.

Some of the conditions disclosed by these upper air observations are quite interesting. At times the temperature at an elevation of several thousand feet has been found to be as much as 15° higher than at the surface of the earth. Again, the kites carrying the instruments would pass through swiftly moving air at the surface, only to encounter a stagnant condition at higher levels. Often what appeared to be a deep covering of clouds would prove to be only a thin layer, while in other cases the kites have traveled through a cloud mass more than a mile in thickness, the automatic register of temperature indicating when the kites entered and when they emerged from the cloud stratum. All of the data thus gathered have an important bearing on the coming weather conditions for the middle Atlantic and New England States, and are therefore telegraphed to Washington each evening for consideration by the forecaster. At times, especially during the prevalence of unexpected conditions such as have just been noted, they have prevented erroneous deductions that would have arisen from a study of surface conditions alone, and have thus materially added to the efficiency of the Weather Service.

The electric and magnetic conditions of the earth and air are continuously recorded at the Mount Weather research institution. Observations are being made with a view to determining the amount of heat in the atmosphere, and studies of the temperature at the earth's

surface and of the various forms of energy that reach us from the sun are being carried on. An effort is being made to discover the relation between these various conditions and our weather, although we have not yet learned how best to interpret and apply all the data thus being secured.

It is a matter of gratification to the Department to know that the development of the Weather Service has been such as to attract attention abroad. To such a degree is this true that during the past ten years representative scientists have been sent by the Governments of nearly all of the more advanced nations to study our system, and more especially of late to learn what we are doing at our research institution at Mount Weather. There are now on duty at the Weather Bureau several students sent to us by other countries, pursuing their studies under the professors of our Bureau.

Another important departure, made possible by continued study of the science underlying the art of weather forecasting, is the making of long-range weather predictions. These were begun for practice purposes, but not for publication, about one year ago. Their accuracy became so marked that within the past few months these predictions have been given to the public. An instance of their value, equally demonstrated on many other occasions, is found in the case of the drought that covered the greater part of the country from the Rocky Mountains eastward during August and September, 1908. On September 22 the Bureau announced that early in the following week general rains would set in over the Rocky Mountain Plateau and extend eastward. This prediction was fully verified, a general fall of rain occurring over the entire drought-stricken district within less than half a week after the prediction was made. We do not wish to hold out too alluring a prospect with regard to forecasts of this character, for at times the condition of the atmosphere may be such that long-range predictions can not be made, but we have demonstrated that in the majority of cases we can foretell a week in advance, and with a high degree of accuracy, the general character of the weather that is to come.

This gratifying result has been attained not only by getting observations from the higher levels of the atmosphere, but more especially by the securing of daily telegraphic reports covering the entire northern hemisphere, these being used in the preparation of a meteorological chart of such detail and extent as is attempted by no other weather service in the world. The value of these forecasts to the agricultural and other industries of the Nation can hardly be measured.

All severe storms on the American coasts and lakes and all severe cold waves and frosts in any portion of the United States during the year were successfully forecast.

NEW APPARATUS.

The increasing demands on the Bureau for various meteorological data require almost yearly the invention of new apparatus. During the past year these demands have been met in part by the preparation of the following:

(1) A chart and instrument kiosk, or booth. This is an instrument shelter especially designed for location in the business and news centers of large cities on the street level at places accessible to the public. It will contain and display instruments that indicate and record meteorological conditions, especially temperature and humidity, and will also be used for the display of climatic charts, weather maps, and forecast cards.

(2) A recording hygrometer for stations. This instrument automatically registers the moisture content of the air, which is one of the most important meteorological elements requiring observation.

(3) A telethermoscope. This device, which is constructed for installation within a building, indicates the temperature of the outside air. By its use the Weather Bureau officials are enabled to respond immediately to the frequent requests received for temperature data, without having to visit the instruments.

RIVER AND FLOOD SERVICE.

With each succeeding year the development of agricultural operations and the extension of business interests more or less dependent upon river stages necessitate some broadening of the field of activity of the River and Flood Service, and during the present year new work has been undertaken as follows:

(1) The establishment of a continuous flood-warning service, operating day and night in times of flood, in that portion of the State of West Virginia bordering on the Ohio River.

(2) The establishment of a new river district center at Binghamton, N. Y., with territory comprising that portion of the watershed of the Susquehanna River at and above Binghamton. This territory was formerly a portion of the Harrisburg, Pa., district.

(3) The opening of new river stations in the watershed of the upper Cumberland River, in the interest of navigation and the lumber industries.

(4) The opening of several new stations at scattered places throughout the country, in order to secure increased efficiency in the flood-warning service.

Realizing the fact that the art of river forecasting is dependent upon the intelligent use of data of diverse kinds, and that the exigencies of the Weather Bureau service frequently render it impossible for officials in charge of river districts to systematize and

preserve for future use their knowledge of the regimen of the rivers in their districts, the river and flood branch of the central office at Washington has begun, in cooperation with the district officials, an exhaustive study of the problem. The Ohio River and its principal tributaries as far south as Cincinnati, Ohio, have thus far been studied, and the results in elaborate form have been transmitted to the officials in charge of the various districts for actual use in river forecasting. It is hoped that the scheme for the entire Ohio River, and possibly a portion of one for the Mississippi River, can be completed within another year. The work is necessarily slow, as it involves the discussion of a large amount of data.

METEROLOGICAL RECORDS.

A new series of climatological papers is being prepared, in which the records of precipitation, temperature, dates of the first and last killing frosts, and prevailing wind directions are collected, the precipitation tables including all available data since the year 1871. These reviews are made comprehensive for small sections of the United States, which it is intended gradually to cover in this manner. The papers will be of value to agriculturists, engineers requiring data on water resources, and other citizens who seek information regarding the climate of the several sections.

WATER RESOURCES.

A demand for a better knowledge of the water resources of the United States has become so urgent as to make it advisable to put forth special efforts to supply the necessary data to the public. In the arid and semiarid regions of the West these consist primarily in securing the amount of precipitation from rain and snow in the high levels of the mountains, from which are derived the waters that are used in the storage basins and the irrigation projects now undergoing rapid development. It is a difficult problem to secure regular and accurate observations of the amount of snowfall in the remote regions of the mountains, where there are very few inhabitants, but a special effort will be made by the Weather Bureau to extend the range of observations into the high levels of the mountains.

EVAPORATION STUDY.

In addition to measuring the water resources of the mountains, it is necessary to determine the amount of evaporation in the lower levels, where the storage basins are located. The amount of evaporation in the driest portions of the country, as in the Colorado Desert, may be as much as 8 feet of water annually, although it differs greatly according to circumstances. The importance of securing much more reliable information on this subject has made it desirable to renew

the attack upon the problem. The formation of the Salton Sea in the Colorado Desert, by the overflow of the Colorado River during the year 1906, affords a favorable laboratory on a large scale at which to make the proposed research on evaporation. A preliminary study on this subject was conducted by Professor Bigelow in the summer of 1907 at Reno, Nev., for the purpose of securing sufficiently adequate knowledge of the phenomenon to permit a proper planning of the campaign at the Salton Sea. The necessary plant was installed at the Salton Sea during the summer of 1908, and it is hoped that by continuing the observations for two or three years a satisfactory law covering evaporation generally may be secured. The problem is one of unusual difficulty from several points of view, but its practical value is such as to justify a serious effort to resolve it. The plan of cooperation with other Departments of the Government has been enlarged to include the Reclamation Service and the water resources branch of the Geological Survey, which are specially interested in evaporation at the reservoirs not only of the arid portions of the West, but in the eastern districts of the country. During the summer of 1908 several plants for the measurement of evaporation were installed at the reservoirs of the Reclamation Service and if practicable some other reservoirs in the central and eastern districts will be included. It is important to measure the evaporation in different climates on a uniform plan in order that a comprehensive law may be deduced.

THE TEACHING OF METEOROLOGY.

In pursuance of the policy of the Department to aid in eradicating the superstitions everywhere prevailing with regard to the weather, the officials of the Weather Bureau are encouraged in giving popular lectures or explanations, and, when practicable, offering systematic courses of instruction in meteorology. The minor courses for the benefit of high schools have been numerous and are recorded in detail in the successive numbers of the Monthly Weather Review. Regular courses of instruction were given by Weather Bureau officials at fifteen colleges and universities.

BUREAU OF ANIMAL INDUSTRY.

ANOTHER OUTBREAK OF FOOT-AND-MOUTH DISEASE.

For the first time in six years the country has been visited with an outbreak of contagious foot-and-mouth disease, and the Department is now engaged in a vigorous campaign of eradication. The first news of the disease was received by telegraph November 10 from Dr. Leonard Pearson, State veterinarian of Pennsylvania, who reported that it existed in the vicinity of Danville and Watsontown, Pa. On

the same day Dr. A. D. Melvin, Chief of the Bureau of Animal Industry, accompanied by Dr. John R. Mohler, chief of the Pathological Division, and Dr. R. P. Steddom, chief of the Inspection Division of that Bureau, left for Danville, and they soon confirmed Doctor Pearson's diagnosis.

A quarantine was immediately declared under date of November 12, effective November 13, against the interstate movement of cattle, sheep, swine, and goats from the counties of Columbia, Montour, Northumberland, and Union, and measures were at once taken in cooperation with the State authorities for stamping out the disease by slaughtering and burying the affected and exposed animals and disinfecting the premises which they had occupied. An arrangement was made by which two-thirds of the appraised value of the animals was to be paid by this Department and one-third by the State of Pennsylvania, other expenses to be shared on the same basis.

Within a few days the disease was also found in several other counties in Pennsylvania and in the vicinity of Akron, N. Y., and on November 19 the quarantine was extended to include the entire territory of the States of New York and Pennsylvania. This quarantine prohibited the interstate or foreign movement of cattle, sheep, and other ruminants and swine from either of the States named. Shipments were permitted by rail through those States provided the cars were sealed by the Bureau of Animal Industry before they entered the quarantined territory. Such shipments were allowed to be unloaded in transit only in pens designated by the Chief of the Bureau and which had been cleaned and disinfected. The shipment of dressed carcasses from the States named was permitted only when the hides and hoofs had been removed, and the shipment of hides, skins, hoofs, hay, straw, etc., was forbidden unless such material had been disinfected by the Bureau.

A plan of cooperation was arranged with the State authorities of New York on the same terms as with those of Pennsylvania.

It was fortunate that the Bureau of Animal Industry had available as part of its regular force a large number of trained veterinarians, many of whom had had experience in the successful campaign against foot-and-mouth disease in New England in 1902-3. A sufficient number of these men were quickly ordered to the infected districts and the work of eradication was actively prosecuted. Not only was the work of slaughtering, burying, and disinfecting carried on, but experts were sent to investigate all rumors indicating the presence of the disease in various localities.

It appeared that the cattle causing the Pennsylvania outbreak came through the Buffalo stockyards, and from Buffalo suspicion pointed to Michigan. Inspectors were dispatched to the latter State, and on November 23 I went to Buffalo in company with the Chief of the

Bureau of Animal Industry to give personal attention to the situation. Evidences of infection from Michigan became so strong that I immediately proceeded from Buffalo to Detroit. On arrival in the latter city on the night of November 24, positive reports were received from our inspectors that the disease existed in several herds in Wayne County, and I at once declared a quarantine on the State of Michigan, to take effect at 6 o'clock the following morning.

On November 27, the disease having been found in Carroll County, Md., just over the Pennsylvania border, a quarantine was placed on the State of Maryland. The operations in Michigan and Maryland are being conducted on the same cooperative basis with the State authorities as in the other States.

It now seems clear that the present outbreak had its origin near Detroit and that the infection in the other States came from that source. The Michigan cases were of longer standing than those found elsewhere, and the Department inspectors in tracing the movement of animals which appeared to have spread the contagion were able in most cases to connect them with the Wayne County outbreak.

While it will not be surprising if a few additional diseased herds are found in the localities where the contagion is known to exist, it is hoped that all centers of infection have at last been located and that there will be no further extension of the infected territory. After all known affected herds have been slaughtered and buried and the premises disinfected, it will be necessary to make a careful and thorough inspection from farm to farm in the infected region in order to detect any contagion that may possibly remain. With the combined efforts of the State and Federal authorities there is every reason to believe that the disease will be eradicated within a reasonable time.

The expense of this work will be heavy, and I shall have to ask Congress to make an appropriation sufficient to cover it. For the present the expenses are being paid from the regular appropriation for general expenses of the Bureau of Animal Industry, but this appropriation is not large enough to stand the drain which is being made upon it without seriously affecting the regular work of the Bureau during the remaining portion of the fiscal year.

As foot-and-mouth disease is strictly a contagious disease and has not been known to exist in the United States since 1903 until the present outbreak, it is supposed that the infection was introduced in some manner from abroad, though in just what manner the Department has not yet been able to determine. In view of our strict quarantine on imported animals and the fact that susceptible animals are not allowed to be imported at all from countries where this disease is known to exist, it does not seem possible that the contagion could have been brought in with live animals. It seems more prob-

able that it was introduced with some material, such as straw, or with merchandise, or on the clothing, or with the effects of immigrants, or with biological products.

The Secretary of Agriculture already has power under existing legislation to enforce measures to prevent the introduction of contagious diseases from abroad so far as they are likely to be brought in with imported animals or with hay, straw, forage, or similar material, or meats, hides, or other animal products, from infected countries. No authority is given, however, to prevent the introduction of destructive animal diseases by the importation of virus or cultures of organisms causing such diseases, and I recommend that Congress enact a law which will empower the Secretary of Agriculture to guard against this danger. Such a law should prohibit the importation, except with the permission of the Secretary of Agriculture, of any virus that may be infectious for domestic animals. With this authority the Department could supervise such importations in such a way as to prevent the introduction of contagion by careless and irresponsible persons, while not interfering with any proper scientific work by responsible persons.

THE MEAT INSPECTION.

This was the second year of operation under the new meat-inspection law, and the experience gained has been productive of improvement in the methods of carrying on the work, while the regulations issued have been based on the best scientific knowledge and judgment available. There were engaged in this branch of the service at the close of the fiscal year 2,203 persons, of whom 616 were veterinary graduates. This force exercised a strict supervision over the slaughtering and packing operations at 787 establishments in 211 cities and towns. Compared with the previous year this is a gain of 79 establishments and 25 cities and towns.

As an example of the rigor of the inspection it may be stated that inspection was withdrawn from 8 establishments during the year because of violations of the regulations.

The present inspection deals not only with the health of the animals slaughtered for meat, but also with the sanitary conditions of preparation and honesty of labeling. The veterinary inspection before and at the time of slaughter is supplemented by subsequent examinations of the product, a laboratory inspection to determine the bacteriological and chemical conditions, and careful supervision of all of the various processes of preparing, curing, canning, etc. The thoroughness of the work has had the much-desired effect of greatly improving the sanitary condition of slaughterhouses and packing plants and of maintaining confidence in the wholesomeness of the products.

REPORT OF THE SECRETARY.

During the past year 53,996,511 animals were inspected before slaughter. Of this number 34,980,571 were hogs, 9,778,189 were sheep, 7,198,224 were cattle, 1,993,461 were calves, and 46,066 were goats. The animals inspected at slaughter numbered 53,973,337, an increase of 6 per cent over the previous year. Of these, 175,126 carcasses and 704,666 parts were condemned, 108,519 carcasses were passed for lard and tallow, and 53,689,692 passed for food. Tuberculosis was the cause of condemnation of about three-fourths of the cattle carcasses and about two-thirds of the hog carcasses that were condemned, and the majority of the other condemned hogs were affected with hog cholera and swine plague.

During the year the Government inspectors passed on nearly six billion pounds of meat-food products processed under their supervision.

There were condemned on reinspection during the year 43,344,206 pounds of meat products which had become sour, tainted, putrid, unclean, or, in the case of fats, rancid, since inspection at slaughter.

There was an increase of 13.8 per cent in the quantity of meats and products certified for export as compared with the previous year. Certificates to the number of 122,295 were issued, covering 1,545,761,808 pounds.

NEED OF STATE AND MUNICIPAL INSPECTION.

The Federal law has no power over products prepared and consumed within the limits of a State, and a large amount of the meat supply—almost one-half the entire slaughter of the country—comes within this class. The Department has found that the worst sanitary conditions exist at many abattoirs where such meats are produced. It is only natural that suspicious and diseased live stock, such as would fail to pass the Government inspection, find their way into these small establishments, to be thereafter sold and consumed within the State. The Department has, moreover, frequently found preservatives in meats prepared by local butchers. It is therefore very important that State and city health authorities should provide adequate protection to their people by inaugurating a system of abattoir inspection that will do away with the evils mentioned. Unfortunately but very few States have as yet realized the importance of this matter. It should be emphasized also in this connection that a mere examination of meat exposed for sale is insufficient. The only way in which consumers can be protected against diseased meats is by competent veterinary inspection of the carcasses at the time of slaughter, and this is a class of inspection that is very seldom found aside from the Federal inspection.

INSPECTION OF EXPORT ANIMALS.

The routine work of the Bureau of Animal Industry includes the inspection of animals for export and of the vessels carrying them. During the year 638 inspections were made of vessels in order to see that the fittings, equipment, ventilation, feed, water, attendants, etc., complied with the regulations.

Our very large trade in live cattle with Great Britain is well known. This, together with other foreign consignments, made a total of 448,163 animals inspected for export, and as some were inspected more than once there were 757,890 inspections made. Of the animals sent to Great Britain 381,684 were again inspected on arrival at British ports by Bureau inspectors stationed there, and the losses in transit were less than one-fourth of 1 per cent.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

A very necessary part of the work in controlling contagious diseases of live stock is the rigid inspection of all foreign animals at the ports of entry. In addition to the inspection a quarantine is imposed upon animals from all parts of the world except North America. During the fiscal year 250,890 imported animals were inspected, and of these 1,494 were quarantined.

CONTROL OF CONTAGIOUS DISEASES OF ANIMALS.

TEXAS FEVER.

Gratifying progress has been made in eradicating the southern cattle tick, which spreads the infection of Texas fever and constitutes a heavy burden to the section involved. Since the beginning of this work less than three years ago nearly 64,000 square miles of territory have been freed from this troublesome and costly pest. The work is being done in cooperation with the authorities of the States concerned. There is no question as to the ultimate success of this great undertaking provided the assistance of the States and of the cattle owners themselves is forthcoming. As a result of this work 40,798 square miles were released from quarantine during the fiscal year. This territory was located in California, North Carolina, Tennessee, Virginia, Arkansas, Oklahoma, and Texas. Besides these States active work was carried on in Alabama, Georgia, Louisiana, Mississippi, Missouri, and South Carolina. In connection with this work 2,271,436 cattle were inspected during the year.

SCABIES OF SHEEP AND CATTLE.

Very effective work has been done toward eradicating the diseases known as "scabies of sheep and cattle." During the year there have been released from quarantine on account of sheep scab the States of

Idaho and Wyoming, and since the close of the fiscal year an order has been issued releasing Kansas and Nebraska and portions of North Dakota and South Dakota. There were released from the quarantine for scabies in cattle 4 counties in Kansas, 57 counties in Nebraska, and portions of North Dakota and Colorado. The number of inspections of sheep was 59,471,141, and the dippings 17,589,578. Of cattle there were 16,920,100 inspections and 1,527,280 dippings.

TUBERCULOSIS.

The question of tuberculosis in animals, especially in dairy cattle, whereby human beings are liable to be infected through the products, has for some time been an acute one. Statistics show that the disease is on the increase, and it is therefore imperative that efforts be made to cope with this great evil. A conservative estimate was recently made by the Chief of the Bureau of Animal Industry, based on the meat inspection and the records of the tuberculin test, which shows the percentages of our animals affected as follows: Beef cattle, 1 per cent; hogs, 2 per cent; dairy cattle, 10 per cent. The financial loss to our stockmen and dairymen was estimated to be fully $14,000,000 per annum.

Tuberculosis can be eradicated from our animals only by means of systematic work of the Federal and State authorities in cooperation. Much can be done in the way of tracing the centers of the disease by means of our meat-inspection service. This is proved by what was accomplished during the past year in cooperation with the States of Nebraska and Wisconsin. When animals from these States were found by our meat inspectors to be tuberculous, the State authorities were so informed, and in the case of Nebraska upon tracing the animals back to the farms it was discovered in every instance that there was tuberculosis among the stock that remained. In order to make this feature of the work thorough, the various States should require shippers to tag their live stock sent for slaughter, especially cows, in order that the centers of the disease may be located and the authorities be enabled to stamp out the infection at its source.

In order to discover the disease, the tuberculin test should be systematically applied. The safest way of disposing of affected animals is to kill them, but in order to reduce the financial loss they should be slaughtered at abattoirs having Federal or other competent veterinary inspection. By this means many of the slightly affected carcasses could be safely utilized for food and thus made to yield their meat value. Especially valuable animals might be kept for breeding purposes under the Bang system of segregation.

Perhaps the greatest obstacle to the eradication of tuberculosis from our herds is the expense of the work and the payment of compensation to owners for the slaughter of their diseased animals. In such

work that is largely for the public good it seems only just that the Government and the States should provide indemnity for at least a part of the loss. The benefits of eradication would unquestionably justify the expense, and when our herds have once been freed from tuberculosis it should be comparatively easy to keep them in that condition.

Work done at the experiment station of the Bureau of Animal Industry has shown that cows, seemingly in good health but which had reacted to the tuberculin test, were expelling myriads of tubercle bacilli in their feces. In ordinary dairy practice particles of this soil get into the milk, and thus two of the commonest articles of food —milk and butter—become contaminated. Analysis of market milk supplied to the city of Washington disclosed that fully 1 sample in 20 was infected with tubercle bacilli, and experimental work with butter showed that the germs will remain alive and virulent in the ordinary salted kind for one hundred and sixty days, or close upon six months.

HOG CHOLERA VACCINE.

At last the problem of discovering a successful method of preventing hog cholera seems to have been solved by the Bureau of Animal Industry. The vaccine or serum prepared according to the methods of Dr. M. Dorset, chief of the Biochemic Division of that Bureau, has been further tested in a practical way during the year, not only by the Department, but by some of the State experiment stations, and its efficiency as a preventive measure has been amply demonstrated. The Bureau has carried on field tests during the year on 50 different farms and has treated approximately 2,000 hogs, with the following results: In herds which had not been exposed prior to treatment, but in which hog cholera appeared subsequent to treatment, all of the vaccinated hogs remained well, while more than 64 per cent of the unvaccinated hogs, which were otherwise kept under the same conditions as "checks," died. In the herds which had been exposed before treatment but which were apparently well when vaccinated, only 4½ per cent of the treated hogs died, while approximately 90 per cent of the checks were lost. In the herds where the disease existed at the time of treatment only 13 per cent of the treated animals were lost, while 74 per cent of the checks died.

In a series of careful tests carried on by Dr. J. W. Connaway at the Missouri experiment station with serum prepared by the Department method the efficacy of the treatment was confirmed, and in a report of this work he said: "The results of these tests are so satisfactory as to leave in every mind no doubt as to the great practical value of this method of preventing hog cholera."

Thirty-seven herds were treated in Michigan under the direction of the State experiment station, and in nearly every case the disease had developed before treatment was begun. Out of 1,819 hogs treated, only 226 were lost.

The director of the North Dakota experiment station reports that when the disease recently appeared in the station herd the Department method of treatment was promptly applied, with the result that not a single animal died. As a further test the vaccinated animals were subsequently exposed to diseased hogs, but none contracted the disease.

The success which has attended the use of this treatment has been such as to warrant the use of the vaccine as an agent for combating the disease throughout the country. To prepare the vaccine on such a large scale, however, is beyond the power of this Department, and steps have been taken to interest the various States in the preparation of the serum. In accordance with this plan conferences of State veterinarians have been held at the Bureau experimental farm at Ames, Iowa, where opportunities have been given them to observe and learn the methods of producing and applying the serum. Already a number of State experiment stations are preparing and distributing the vaccine, some of them making a charge to cover the cost, and it is expected that other States will soon make the necessary provision for such work.

RABIES.

The presence of rabies, or hydrophobia, in dogs is still a menace to our people, and its disseminator, the rabid dog, is all too often allowed to roam at large and unmuzzled. The situation in the neighborhood of the National capital last spring became so alarming that the Commissioners of the District of Columbia were prevailed upon to issue a dog-muzzling order. While the prevalence of the disease has been diminished to some extent, the muzzling order has not been well enforced, and cases of rabies continue to occur.

The pathological laboratory of the Bureau of Animal Industry has continued to examine all animals sent there suspected of having rabies. During the fiscal year 117 such animals were examined and 82 of them were found to have been affected with the disease. The great majority of these came from Washington, D. C.

A case of rabies that occurred in a horse at the Bureau experiment station is of special interest. The horse was bitten by a dog which was found to have been affected with rabies. The horse, however, did not develop the disease until one hundred and thirteen days, or about three and one-half months, after it was bitten. It fractured one of its hind legs during a violent paroxysm of acute rabies and was consequently destroyed.

INVESTIGATION OF OTHER DISEASES.

Scientific investigations of various animal diseases and parasites have been carried on. The study of swamp fever of horses, in cooperation with the Minnesota experiment station, has continued with promising results, but has not been completed. Two animal diseases which have only recently been recognized in this country—epizootic lymphangitis of horses and chronic bacterial dysentery of cattle—are also being studied.

The vitality of the typhoid-fever bacillus in butter and milk has been investigated, and it has been shown that this organism will remain virulent in butter for about five months and in milk for a period far in excess of the time that it is ordinarily kept.

The experiments in connection with roundworms of sheep during the past year have chiefly concerned the problem of keeping lambs free from infection with these parasites. Should this work be as successful as anticipated it is planned to carry out practical trials under farm conditions during the coming year.

Studies of white diarrhea in chicks have thrown important light on a disease which has caused heavy losses, and the knowledge gained will enable poultrymen to combat it with more success.

THE INTERNATIONAL CONGRESS ON TUBERCULOSIS.

The Bureau took an important part in the recent International Congress on Tuberculosis. It provided an exhibit of pathological specimens, and several members of its staff presented papers and took part in the arrangements and proceedings.

BLACKLEG VACCINE, TUBERCULIN, AND MALLEIN.

The Bureau has continued the preparation and distribution of vaccine to prevent blackleg in cattle. About 1,200,000 doses were distributed to stock raisers during the fiscal year, and reports indicate that the vaccine continues to be highly effective.

Tuberculin, for the diagnosis of tuberculosis, and mallein, for the diagnosis of glanders, are supplied to official veterinarians and health officers. During the year 213,015 doses of tuberculin and 52,556 doses of mallein were prepared and sent out.

LIVE STOCK IN PORTO RICO.

An investigation of the diseases and conditions of live stock in Porto Rico was undertaken during the past year. The majority of the island cattle carry an admixture of zebu blood as the result of the introduction of a number of zebu bulls in 1858. They are noted for superior size and working ability. Cattle all over the island are

infested with ticks. The principal diseases are blackleg among cattle and glanders and epizootic lymphangitis among horses and ponies. There is no mange and no tuberculosis.

ANIMAL HUSBANDRY WORK.

HORSE BREEDING.

The work in breeding American carriage horses, carried on in cooperation with the Colorado experiment station, continues with good results, and some very promising animals have been produced. During the fiscal year 4 Kentucky mares were added to the stud, which at the close of the year comprised 63 animals.

The stallion General Gates, two mares, and a filly were bought for the Vermont work in breeding Morgan horses, and the farm at Middlebury donated by Mr. Joseph Battell has been improved. Horses used in this work were exhibited at two fairs in Vermont and attracted very favorable attention. The Morgan stud consisted of 25 animals at the close of the fiscal year.

An experiment is also in progress in Iowa, in cooperation with the Iowa experiment station, to evolve a breed of American draft horses. The animals in this stud at present are imported Clydesdales and Shires. The horses have done well since their arrival in the summer of 1907, but no foals were obtained during the fiscal year.

CLASSIFICATION FOR AMERICAN CARRIAGE HORSES.

The classification proposed for American carriage horses by a committee representing the Department and certain breeders' associations was adopted in whole or in part by twelve fairs for the season of 1908, and a number of creditable exhibits were made in these classes.

EXPERIMENTS IN BEEF PRODUCTION.

Two series of experiments in feeding cattle for beef production have been carried on in cooperation with the Missouri experiment station, with a view to testing the economy of certain rations and supplementing the pasture with different nitrogenous feeds.

Similar experiments are also being continued in Alabama to study this subject under southern conditions.

POULTRY INVESTIGATIONS.

The cooperative poultry work at the Maine Agricultural Experiment Station, begun in 1904, has been continued and some of the results are being prepared for publication. Other experiments in feeding poultry by different methods are in progress at the Bureau experiment station, but have not progressed far enough to yield definite results.

During the year a study was undertaken of the conditions surrounding the production, transportation, and marketing of eggs, with a view to determining some of the causes of deterioration in quality and consequent loss in value. It is believed that information is being obtained which will be of much value in pointing out means for improving the quality of the southern and western eggs shipped to the East and for saving a considerable unnecessary loss to the producers.

WORK RELATING TO THE DAIRY INDUSTRY.

SOUTHERN DAIRYING.

The educational work for the development of dairying in the South has been continued with excellent practical results. Some of the drawbacks to the southern dairy industry are the lack of a sufficient number of good cows, the lack of home-grown feed, and the lack of suitable buildings. Efforts are being made to assist the southern farmers along all these lines. In order to determine which cows are profitable and which unprofitable, the farmers are encouraged to keep records of their herds. As an example of what is being accomplished in this respect, it may be stated that twelve months' records of 719 cows in small herds located in various parts of the South show an average profit per cow of $32.61; the best cow showed a profit of $94.40, and the poorest cow a loss of $3.73. The average profit of the best 10 cows was $79.24, while the poorest 10 cows made an average loss of 1 cent. It often happens that what are regarded as the best cows show, when tested, much poorer results than others in the herd, and it is by keeping records and compiling such information as the foregoing that the farmer is enabled to eliminate the poorer animals and to bring up the average production of his herd to a profitable point.

The Bureau has also assisted the southern farmers by furnishing plans for and supervising the erection of 45 silos, 28 barns, and 5 dairy houses during the fiscal year, and a larger number of such buildings are projected for the coming year.

It is the purpose of the Department to carry on this educational work in the South in cooperation with the state authorities and institutions so far as possible, and to prevail upon the States to take up and continue the work so that the Department may, after getting it well started and showing its benefits, withdraw and devote its attention to other fields. Several of the States have provided men and appropriations for such work, and as the good results become more apparent the interest is increased.

DAIRY PRODUCTS INVESTIGATIONS.

The investigations to determine the cause of the so-called fishy flavor of butter are not yet complete, but have given important information which it is believed will assist butter makers in overcoming

this trouble. Acid appears to be in some measure responsible for this flavor, but certain results have indicated that the controlling factor is the treatment of the butter in the churn.

Different lines of experiments in making the Cheddar, Swiss, Camembert, and Roquefort types of cheese have been continued, and some of the results have been published. This work has a practical bearing in assisting American cheese makers to produce some of the kinds of cheese that are imported in large quantities.

MARKET MILK INVESTIGATIONS.

Considerable work has been done during the year for the improvement of milk supplies. This has usually been done by giving assistance to city boards of health and to dairy farmers. One hundred and forty cities have been given more or less assistance during the year and a number of these have made marked improvement in their milk supplies. The score card has proved to be an important agency in improving the sanitary condition of the dairies. By means of this card the specific features are rated on a definite scale, and it is much easier for the health authorities and the dairymen to determine just what conditions need improvement. Two hundred and six dairies with 8,527 cows were inspected and scored during the year, the average score being 51.05 on a scale of 100. Reports have been received on about 10,000 dairies that were rated by officials and persons outside of the Department, and the average score of these was 52.05. It appears that there is a greater need for improvement in methods than for better equipment.

DAIRY MANUFACTURES.

The Bureau has also continued its work of inspecting butter as received at 3 of the principal markets and reporting its condition to the creamery, the purchaser, and the dairy and food department of the State where the creamery is located. By this means many of the creameries have been enabled to improve materially the quality of their product. It has been found, however, that much of the poor quality of butter is due to the fact that some of the cream is very old when received by the creamery and it is impossible to make good butter from such material. This condition is due partly to the competition between the local and the "centralizer" creameries and partly to the way the cream is handled on the farm. Since the introduction of the hand separator the farmer has found that he can keep the cream longer on the farm and take less care of it and still find a market for it, and he is taking advantage of this.

An increasing number of creameries are regularly reporting to the Bureau, and with the information received it is sending out a monthly circular letter in addition to other correspondence, giving advice as

to remedying losses and other unfavorable conditions. As an example of the practical benefit of this work reports of creameries in Minnesota, Iowa, and Wisconsin, where the work has been in progress for two years, show that within the past year these creameries have increased their average overrun to an extent which increased their returns by about $130,000.

RENOVATED BUTTER INSPECTION.

In the enforcement of the law regarding the inspection of renovated butter the Bureau has exercised supervision over 46 factories and has inspected their product and the material entering into it. There was produced during the fiscal year 50,658,158 pounds of renovated butter, a decrease of 12,261,840 pounds.

BUREAU OF PLANT INDUSTRY.

During the past year the work of the Bureau of Plant Industry has been pushed forward vigorously. Its research work in the laboratory has resulted in a number of important discoveries, its experimental field work has developed new methods of applying fundamental principles for the benefit of agriculture, and its efforts in the line of practical demonstrations and cooperation with farmers, fruit growers, and others have brought the Department into close contact with the people.

SEEKING NEW CROPS FOR THE AMERICAN FARMER.

Explorations in China, Korea, and Siberia.—In pursuance of a general policy, energetic efforts have been put forward by the Bureau the past year in the matter of securing new crops and establishing new agricultural industries. During the year more than 2,000 carefully selected, newly introduced plants have been brought in and placed in the hands of thousands of private experimenters and official plant breeders, and others attached to State and other experiment stations of the country. We are still sending abroad many millions of dollars for products which may well be grown at home, and in carrying out the general plan of securing data bearing upon the production of these crops and the crops themselves, the explorations and other work outlined below were carried on. One of the agricultural explorers, Mr. Frank N. Meyer, who for the past three years has been in China and Siberia, returned to this country in July after a continuous search during that time for new crops. This is one of the most extensive pieces of agricultural exploration work which the Department has undertaken. In addition to the many hundreds of new plants which Mr. Meyer secured he has brought back a fund of information which will be valuable in connection with our various lines of work here. Mr. Meyer devoted considerable attention to the

Chinese methods of growing crops under dry-land conditions, and the information he secured regarding dry-land farming practices, horticultural methods, market-gardening operations, and the vast forestry practices of the Chinese Empire reveals in a remarkable way the wonderful variety of plants grown by the Chinese and the great similarity of the climate of eastern Asia to that of the United States.

The explorations made by Mr. Meyer in certain of the Chinese provinces reveal the presence of an extensive orchard industry which is worthy of serious consideration for our dry southwestern regions, the Chinese regions and our southwestern country being very similar in climate and soil. Mr. Meyer found extensive orchards of what is known as the "Chinese date," a drought-resistant fruit tree of which the Chinese have developed hundreds of varieties and of which the dried fruits form a most palatable and valuable fruit product with which this country is entirely unfamiliar. He secured numerous varieties of this date, among which was a seedless sort which is now being propagated for distribution in the Southwest.

A number of varieties of new seedless persimmons have been introduced. These are quite different in form and presumably hardier than any of the Japanese persimmons which are being grown on a commercial scale through the South. One variety has already been fruited here, and some of the fruit attained a diameter of 4 inches. It is perfectly seedless, not astringent as the ordinary Japanese forms are when hard, does not fall off readily, and promises to be an excellent shipper.

A large collection of wild and cultivated pears was secured; also varieties of wild walnuts and chestnuts. There were also secured wood for the propagation of the famous Feitcheng peach, specimens of which weigh over a pound, as well as new apricots and wild apples which it is believed will be of particular value to the breeders of the Mississippi Valley, who are developing hardy forms of these plants. A great many new ornamentals have also been obtained, such as new spruces, new elms, and new pines, these coming from the bleak, arid regions of the Wutaishan, and in all probability being adapted to sections of this country where ornamentals of this nature have not hitherto been grown. A special effort was made by Mr. Meyer to secure new ornamentals suitable for parks and public grounds. Many of these things have been brought in and are now being tested and grown by the various cooperators of the Department.

Explorations in central Asia.—Recognizing that the Great Plains region of this country is in much need of assistance, explorations were inaugurated the past year with a view to securing forage and other crops for this vast section of the country. Early in the summer Prof. N. E. Hansen, of the South Dakota experiment station, was sent out to make a thoroguh exploration and investigate the prob-

able value for the United States of certain promising alfalfas, clovers, grasses, and other crops of southern, central, and western Siberia. Professor Hansen took with him early in July three Russian assistants and proceeded to the regions around Omsk for the purpose of arranging to collect large quantities of seed of three yellow-flowered alfalfas, which are known to be cold-resistant, strong-growing, and erect types and are, furthermore, likely to be of great value for hay as well as pasture in the northwestern sections of this country. The latest information from Professor Hansen indicates that he has located large areas of the western Siberian alfalfas and has arranged for considerble quantities of seed. In a letter dated October 24, from Omsk, Professor Hansen reported the finding of good seed of one of the three yellow-flowered Siberian alfalfas which he started out to secure. This is the same plant found by Professor Hansen in 1906, and he now states that it is a fine, erect-growing type, with large leaves and large, flat pods. Both the Mongolian and flat-pod alfalfas are now coming to America for the first time, and Professor Hansen deems them very promising, owing to their extreme hardiness and their strong, erect habit, which will make mowing easy.

Professor Hansen also reports the finding of the Siberian lupine clover, which extends to 70° north latitude, which is also a fine, erect plant well liked by stock; also two wild red clovers, which will no doubt be more valuable for the North than our present stock of southern origin, as he got them where the mercury freezes in winter. Some fine Siberian vetches have also been secured. Owing to the nature of this work, it will not be practicable to secure large quantities of any of the seeds. Commercial seed houses in this region are unknown, and almost the only way of securing the valuable things indicated is through hand gathering and hand picking by peasants and others hired for the purpose.

This work of Professor Hansen is carried on in a climate very similar to that of the northern Great Plains region, and it is hoped that the new introductions will add materially to the wealth of the northwestern farms and pastures. The growing need for these crops is manifested in sections where grain has been the mainstay of the farmers. To successfully continue the growing of grain, rotations are essential. Legumes, therefore, such as clovers and alfalfas, which will fit into the conditions of this region will not only be of great value in giving the farmers wider opportunity for diversification, but will also be valuable in building up and maintaining the fertility of the land.

New forage plant for the Southwest.—Shaftal, a new and promising clover, secured last year by the Department from the valleys of the Himalaya Mountains, near the border of India, has proved an exceedingly good producer in the hottest parts

of the Southwest. It will doubtless prove valuable in rotations in this section, and with the advent of Egyptian cotton culture its usefulness will probably be greatly increased. It has grown most successfully in the hottest irrigated valleys of the Southwest. Prof. N. E. Hansen, whose attention was called to this promising plant before he left on the trip already referred to, reports that he has found it in considerable quantity and will be able to forward seed for experimental purposes.

Bamboo introductions.—The unusual and important uses to which the bamboo is put by our neighbors in the Orient and the discovery by means of various importations that this useful plant can be grown along the Gulf States and in California have induced us to engage an expert in Japan, who has made purchases of several thousand bamboo plants, which he is now shipping to this country. These will form the nuclei of small plantations established in the Southwest, where the climate is suited for the crop. If it is found that the bamboo may be successfully grown on these plantations its cultivation will be extended, with a view to getting the wood introduced into various channels of trade here.

Explorations in Sweden, Denmark, and Germany.—In order to ascertain why American barleys are considered by experts inferior to the best European-grown barley, Dr. Albert Mann, an expert of the Bureau, was sent as an explorer to Sweden, Denmark, England, Germany, and Austria to make a thorough study of the methods employed by our European neighbors in the improvement of one of their most important grain crops. Doctor Mann has secured data regarding the latest processes used by European workers in the breeding and selection of barley for special purposes, and in particular the Svalöf system of collecting and classifying new varieties of this and other grains, and he has been successful in perfecting methods for rapidly determining the value of barleys, methods which will be very useful in the continuation of the important work on the improvement of this crop now under way.

Matting plants for floor mattings.—As the result of previous explorations in the Orient and elsewhere, and as announced in previous reports, the Department has put itself in possession of a collection of matting plants of the best varieties, and the present season has seen the production of matting straw which has been pronounced by experts equal in quality to that grown in the Orient. The first piece of home-woven straw matting has been produced here from straw grown by the American farmer, and the experts are now at work devising cheaper methods of planting, harvesting, splitting, and curing these matting plants, large quantities of which we import every year. While this work is progressing satisfactorily,

attention should be called to the fact that in the transplanting of any crop or industry from one country or region to another unexpected difficulties may arise. The cheap labor of the Orient can not be utilized here, and in consequence many of these new industries require special machinery for handling the crop. This is the case with matting. These new problems are now under investigation, and it is confidently believed that the industry can and will be established here.

Reed matting lath.—As an outgrowth of investigations in the manufacture of floor matting, our experts have discovered a new and probably profitable use for the common reed which grows so abundantly along the waterways of the United States. In Sweden, Denmark, and Germany these reeds are used in place of laths, and the loom manufacturers of New England have been encouraged to work out a feasible machine for the weaving of these reeds into matting. They have been so successful that several of the best builders in the country pronounce the product of great promise as a substitute for the ordinary lath. There are thousands of acres of what are now considered practically waste land that might be devoted to the production of reeds suitable for the manufacture of the lath matting. This phase of the problem is being investigated by the Bureau.

Egyptian cotton in the Southwest.—The United States imports about $15,000,000 worth of Egyptian cotton annually for the manufacture of special fabrics. The growing, grading, and handling of this crop have been so perfected that the product is exceedingly uniform, and the fiber being of a very high quality, fancy prices are always received for it. For a number of years the Department has been endeavoring to establish this crop in the United States. Several years ago some work was undertaken in the Southwest, notably at Yuma, in cooperation with the Reclamation Service on one of their projects. This work has already progressed sufficiently to warrant us in saying that there is a great promise of establishing an important cotton industry in the region mentioned.

The past year a total of about 40 acres was planted to Egyptian cotton at various localities in southern Arizona, seed of the acclimatized strain that has been grown for six years in the Southwest being used. The indications point to an average yield of 1 to 1½ bales per acre wherever the planting was done in good season and the cotton received reasonable care. A good commercial fiber was obtained, satisfactory in strength and fineness but not in the matter of length and color. It is planned to sell the product at the highest price obtainable in order to ascertain approximately what profit can reasonably be expected by growers of Egyptian cotton in the Southwest. The marked interest in these experiments evinced by a number of

American manufacturers of Egyptian cotton makes it reasonable to expect that the Arizona-grown fiber can be marketed advantageously.

The peculiar climatic and soil conditions in this region have developed a number of unexpected problems which will necessitate careful laboratory and field work for settlement. It is found, for example, that for reasons not yet fully explained cottons hybridize naturally. In view of the fact that one of the essentials in establishing this industry is the securing of a uniform product, there is some careful work ahead in the matter of determining the causes of the variations noted, and fixing by practical methods the types which the market demands and for which it is ready to pay the highest price.

New tropical and semitropical fruits.—American fruit growers living in the subtropical areas of the United States have fruited this year an unusual number of the fine East Indian mangoes which have been imported from time to time by the Department and distributed among them, and with the living material now on hand it should be feasible to go ahead and establish important tropical fruit industries. Many of these valuable mangoes have been placed in Florida, and are being successfully fruited there.

The growing of Dutch bulbs in America.—The United States imports bulbs each year to the value of $300,000 to $400,000. A number of efforts to grow these bulbs in the United States have been made. Certain sections of the State of Washington seem to be well fitted for this sort of work. Various private parties have inaugurated the work, but for one reason or another they have not been entirely successful. The failure so far to place commercial bulbs on the market is not believed to be due to the difficulty of production so much as to the fact that other horticultural industries in this comparatively new region have offered more opportunities for ready returns. Transportation conditions and freight rates have also militated to a certain extent against the industry. The people of Bellingham, Wash., however, are very much interested in the industry, and have cooperated with the Department in furnishing land, buildings, water, etc., to carry on practical demonstration work for a number of years in the growing of the crop. It is planned to grow bulbs now used by the Department and bought abroad, and by this means aid in demonstrating the feasibility of growing the crop in sufficient quantity for commercial purposes.

EXTENSION OF THE CEREAL WORK.

Durum wheat.—The total production of durum wheat for 1907 appears to have been somewhere between 45,000,000 and 50,000,000 bushels, a little larger than that of the previous year. Of the total crop, over 25,000,000 bushels were exported. For 1908 the crop of durum wheat will probably be something over 50,000,000 bushels.

There is already a large export of the 1908 crop, a considerable quantity having been shipped to Russia, from which country our own seed was orginally obtained. It is evident that the demand will again exceed the supply before the winter is over.

In connection with durum wheat, the operations of the year have witnessed some new enterprises with respect to utilization of the crop. One of the largest milling firms in the country has used one mill entirely for grinding durum flour, while a very large milling concern in another city has launched into an extensive production of durum wheat semolina for macaroni manufacture. Extensive tests have also been made during the year by prominent bakers in this country and Europe in the use of durum wheat flour for bread, all of which have been fairly successful. Scotch bakers are now importing the wheat for bread making. In an agricultural way the chief line of investigation during the year has been a thorough comparison of the best varieties of this wheat. A number of these are being grown and are now being developed as perfectly pure strains. This line of work is highly important, as the original introductions were unquestionably mixed types. It will be the effort as soon as possible to get into the hands of farmers pure seed of the variety that proves best under local conditions of soil and climate.

Extension of the winter-grain area.—With a view of extending the area of winter-grain production in the Northern and Western States the Kharkof strain of the Crimean or Turkey hard winter wheat group has been still more widely grown during the past year, not only in Kansas and Nebraska but in Colorado, Wyoming, South Dakota, Iowa, and portions of North Dakota, Minnesota, and Wisconsin. In all trials of the various winter wheats on State experimental farms in Wisconsin the Kharkof did much better than other varieties, which included two or three other hardy strains from Russia. An important conclusion derived from several years' experiments with this wheat is that it is particularly hardy in cold districts which are also dry—that is, it is rather remarkable in its resistance to a combination of drought and cold.

Important work has been carried on during the year in the improvement of oats and the testing of new types from foreign countries. Special efforts have been put forward to push the production of winter oats through the South. Special efforts, furthermore, have been made to extend the growth of winter barley as a grain crop, particularly through the South and West. In addition to the region of Kansas and adjacent portions of Missouri, Nebraska, and Oklahoma, winter barley has now been tried at a number of points in other States, particularly Indiana, Illinois, and Ohio, and has been unusually successful. The yield per acre continues to be much larger than that of spring barley grown in the same locality.

Important results have been obtained in an effort to further extend the use of black winter emmer as a crop for stock feed on dry lands. A considerable amount of seed of this emmer has now been produced at various points, but not sufficient for general distribution.

Cereals for dry farming.—More attention than formerly is being given to the development of drought-resistant cereals. During the year work has been stated at six different stations located in representative sections of the Great Plains and intermountain areas. Large numbers of varieties of grain are being tested at these stations for their hardiness and drought resistance. While only one year's results have been secured, many new varieties introduced have outyielded ordinary sorts from 20 to 50 per cent.

Improvement of Pacific coast wheats.—The Department has continued its cooperative work in California with a view to the improvement of the wheats of the State. It is highly important to secure more glutinous wheats for the Pacific coast regions, and this is the primary object of the work under way.

Grain sorghums.—Extensive experiments with grain sorghums are being conducted at different points in the Great Plains area. This work has an important bearing on the development of the agricultural resources of the region, and some of the results secured have been promising. Extra-early and dwarf strains of milo and kafir varieties and the recently introduced kowliangs from China have been produced and the area of profitable growth extended. Promising hybrids are being developed into improved varieties.

Extension of the rice work.—Important work has been carried on during the year in cooperation with the Louisiana experiment station at Crowley, La. A study has been made on this farm of the manner and time of opening of the rice flower, which will be of much value in aiding all future work in the cross-breeding of rice. A classification of the known varieties of rice has also been prepared, which will be of use in future investigations. Efforts are being made to extend the rice work through the adoption of better varieties, improved methods of growing crops, and the extension of the area into other regions, notably California and Arkansas.

PROGRESS OF FORAGE-CROP WORK.

During the year the important work of encouraging the production of forage crops throughout the country has been vigorously prosecuted. This work has for its primary object the encouragement of the production of forage crops of various kinds wherever it is possible to do so in connection with other systems of farming. A special effort has been put forward to push the production of leguminous forage crops in the South, to extend the field for alfalfa culture in

the Middle West and East, and to secure and establish forage crops of various kinds, particularly legumes, for the colder Northwest and the dry sections of the Middle West and Southwest.

ALFALFA EXTENSION.—During the past three years an extensive series of cooperative experiments in growing alfalfa has been conducted with farmers in the States of Maryland, Delaware, Virginia, and North Carolina with a view to determining the possibilities of this crop. These cooperative experiments number over four hundred and have been undertaken in many instances with the help of State experiment stations. They have been made primarily to determine the governing factors in the growing of this important crop in the various sections. Some of these factors are now well established, and it is believed that the work done will be of great value in getting this important crop more extensively used throughout the region in question.

WINTER LEGUMES FOR THE COTTON BELT.—Much attention has been given during the past year toward encouraging the greater use of winter legumes. Experiments throughout the South have indicated satisfactory results. Numerous demonstration experiments have been undertaken with farmers in most of the Southern States. In the very numerous instances where failure with these legumes has heretofore been reported the difficulty is found to be due largely to lack of inoculation. Whatever be the factors involved the fact is clear that inoculation is very difficult to obtain in the South except when using soil from an old field of the particular legume planted. The results of the work thus far indicate that crimson clover is to be preferred on the sandy lands, while vetch does best on the heavier soils. Experiments further indicate that when once the land is thoroughly inoculated there is little difficulty in securing satisfactory stands both of vetch and crimson clover when sown in the cotton in late summer.

A NEW LEGUME FOR THE SOUTH.—In 1906 there was obtained from the Philippine Islands a new bean, *Mucuna lyoni*, related to the Florida velvet bean. Although this has been grown but two years, in comparison with the Florida velvet bean it is already demonstrated that it is much more prolific and somewhat earlier, at the same time being just as vigorous a grower. So markedly has its superiority shown itself as regards heavy seed production that many cooperators have not hesitated to predict that it will within a short time entirely supplant the Florida velvet bean. It is not unlikely that this variety will succeed farther north than does the Florida velvet bean, and it is certain that it will ripen its seed considerably farther north than that variety.

COLD-RESISTANT ALFALFAS.—Considerable work has been done during the year by the Bureau in the matter of securing alfalfas that are

cold resistant. The important work of Professor Hansen in this field has already been pointed out. In addition, the Bureau has been engaged in investigations with a view to securing alfalfas that can be used by farmers of the Northwest, where the winters are cold and dry. The value of the Grimm alfalfa for this purpose has already been pointed out. This has been grown in Minnesota since 1857, and has proved quite hardy. The Grimm alfalfa was originally brought to Carver County in Minnesota, and the crop has been quite firmly established in this section and is being gradually extended to other regions, although the seed is somewhat difficult to secure.

The sand lucerns which have been secured give every indication of being perfectly hardy and will undoubtedly be of great value for this northwestern section. Commercial sand lucern seed may be obtained readily from Europe, but unfortunately it often contains much weed seed and is therefore objectionable. On this account the seed production of this hardy alfalfa is being fostered, especially in northern Montana, where the severity of the winters will largely preclude any accidental mixture with nonhardy varieties. In addition to the hardiness of this variety it has proved quite a drought resistant. The remarkable variability that it shows also makes it a most fruitful source for selection for increasing both seed yield and hay production.

TOBACCO INVESTIGATIONS AND EXPERIMENTS.

The tobacco work as outlined in previous reports has been continued during the year. This work has been carried on in the Connecticut Valley, Florida, Texas, Alabama, Kentucky, Tennessee, Ohio, New York, Maryland, and Virginia, the object being to secure improved types by methods of breeding and selection, and to fix these types and establish them, to demonstrate the best means of growing the crops in the various regions, to accomplish the wide distribution of seeds of improved types, to introduce rotation and diversification, to aid in maintaining the fertility of the land where tobacco is made a specialty, to study various diseases, and by work in the laboratory to solve important points concerning the questions of burn, aroma, etc. The work in the Connecticut Valley has placed the industry on a new basis, it having been conclusively demonstrated that the varieties originated are eminently adapted for culture under shade and in the open field. The culture of tobacco under shade in the Connecticut Valley has been put on a profitable basis by the growers through the use of the Hazlewood Cuban tobacco, an extremely uniform variety adapted for culture under shade in this valley, and the use of improved methods of culture, the result of experiments and experience.

Through improved methods of sterilization of tobacco seed beds some very destructive diseases have been eliminated. One of the

most important discoveries of the year resulted in the control of the destructive root-rot in the tobacco fields in the Suffield and other districts of the Connecticut Valley. It has been found that an application of acid phosphate at the rate of 1,000 pounds per acre corrects the alkaline soil conditions in the diseased fields, and it has been proved in extensive field trials that this treatment remedies the abnormal soil conditions brought about by the continued use in large quantities of certain fertilizers and makes it possible to grow normal and profitable crops on the diseased soils.

Important work has been continued in the matter of securing cover crops for the tobacco fields during the winter. Several years ago hairy vetch was introduced into this section, and it has been demonstrated that this crop adds about $18 per acre of nitrogen to the soil, and its value, both as a fertilizer and for improving the humas condition and the physical condition of tobacco lands, is estimated to be worth at least $35 per acre.

In Florida fourteen tobacco breeding fields have been conducted with individual growers. These fields are located so as to secure variety in cultural conditions, soil, and other things. In Texas the work has been mainly in connection with pushing the work of growing wrappers and cigar fillers. Assistance has been furnished growers in the way of expert advice as to methods of culture, curing, and fermentation of the crop. About 75 acres of shaded tobacco and 250 acres of Cuban filler types have been grown in the State. In Alabama the work has been with cigar filler and wrapper tobacco. In Kentucky and Tennessee extensive breeding work and fertilizer tests have been continued with the various types grown there. Similar work has been carried on in Ohio and New York. In addition to the definite experimental work under way in the different tobacco sections the Department is cooperating with a large number of individual tobacco growers who have taken up the systematic improvement of established varieties of tobacco.

One of the important lines of tobacco work is in connection with the export and manufacturing tobacco districts in the States of Virginia, Maryland, and Kentucky. The general aim of this work is to secure data by experiments and investigations and to show by demonstrations how best to build up and restore the fertility of the rundown fields found on the average tobacco farm. Tobacco is a crop of comparatively high commercial value and responds profitably to the liberal use of commercial fertilizers when intelligently applied and adequately supplemented by humus crops. An extensive system of fertilizer experiments, which in some cases have now been going on for four years, has been conducted in a number of locations in the States named and on all varieties of soils, and these experiments indi-

cate how readily tobacco soils known to produce about 800 pounds of tobacco to the acre can be improved so as to produce 1,400 to 1,600 pounds per acre and at a greatly increased net profit. At the same time the work has demonstrated the value of rotations and fertilizers in building up and maintaining the fertility of the land. Fine crops of $2\frac{1}{2}$ to 5 tons of hay per acre have been grown in rotation with tobacco and other crops. This work is being done in cooperation with State experiment stations, all of which are contributing liberally in the matter of expenses involved.

WORK OF THE PLANT PATHOLOGISTS.

Important lines of work in plant pathology have been carried on during the year. Much of this work is necessarily conducted in the laboratories at Washington, but the practical demonstrations and experiments are carried on in the field. Studies have been continued on a variety of bacterial diseases of plants. A bulletin has been prepared and published dealing with the olive tubercle prevalent in California. A serious disease of tobacco, known as "wilt," prevalent in North Carolina and Florida, has been investigated, the causes determined, and results published. Some important studies of the crown-gall of cultivated plants have been carried on during the year. This disease is of bacterial origin. Such galls occur on a great variety of plants, and before the problem of restricting the distribution of crown-gall can be solved we must know whether or not these galls are of common origin. To this end many cross-inoculations have been made. Up to date it has been shown that the micro-organism cultivated from the crown-gall of the peach is able to produce tumors on peach, apple, daisy, and sugar beet. In the last eight or ten years there has been a great deal of investigation of this obscure trouble, and it is gratifying to know that we are at last getting results which promise not only to show the direct cause of the disease but to point the way to practical methods of treatment.

ORCHARD-FRUIT DISEASES.—Studies of orchard-fruit diseases have been continued along a number of lines. In California the Bureau has continued to give expert assistance to the California growers in combating pear blight. The California growers and the State and county horticultural commissioners and the State experiment station are cooperating with the Department in this work. Pear blight during the past year or two has invaded the fine pear orchards of the Rogue River Valley in Oregon, and the Bureau pathologists were called there to assist in the effort to stamp out the disease or control it. Important work has been carried on during the year in connection with the little-peach disease and peach yellows, the winter injuries of fruit trees, the gumming fungus of the peach and other stone fruits

growing in California and other Pacific Coast States, and certain injuries to apple and peach foliage as a result of spraying with Bordeaux mixture and other fungicides.

A NEW SULPHUR WASH.—One of the most important steps in recent years was the discovery made during the season that the self-boiled lime-sulphur wash is not injurious to peach foliage when properly made and will not produce russeting and other injurious effects on apples. Furthermore, it has been found to be about as effective as a fungicide as the standard Bordeaux mixture. Extensive experiments have been carried on during the present year on nearly all of our common fruit diseases which are preventable by spraying. The results have been corroborated and extended, bringing out the value of this excellent spray mixture and demonstrating its usefulness.

SPRAYING DEMONSTRATIONS.—An important line of work in field demonstrations in connection with orchard treatment was carried on in Missouri, Arkansas, Kansas, Nebraska, Illinois, and Georgia. This demonstration work has been very effective in bringing home to the orchardist the most successful methods of treating diseases. The peach and plum brown-rot, the apple scab, bitter-rot, blotch, and leaf-blight, and the cherry leaf-blight are some of the diseases that have been handled the past season over a wide extent of territory.

POTATO DISEASES.—Comprehensive studies of potato diseases are being conducted to solve the new problems constantly arising and to attack old problems from new view points. Late-blight, the principal source of loss in our great potato States, can be controlled by spraying, but there is much need for the introduction of disease-resistant varieties. All of the best European and American varieties have been tested for four years, largely in cooperation with the Vermont experiment station, and it has been learned that there are some very resistant potatoes, but not all of them are desirable in other respects. The production by breeding of new American varieties resistant to disease will be the final solution of this problem.

DISEASES OF TRUCK CROPS.—The great development of the trucking industry along the Atlantic and Gulf coasts has brought with it a host of new problems for investigation. The growers rely almost entirely on commercial fertilizers for the production of their crops, and some have used them exclusively and in excessive amounts until distinct nutrition diseases have appeared and caused much loss. The Bureau is studying these malnutrition problems and has already shown that by a suitable modification of the fertilizer formulas, together with the use of lime, stable manures, and green manures, the diseases may be prevented. Potato spraying—an established practice in Northern States—has not come into use in the trucking sec-

tions. The Department is adapting methods and practices to local conditions, to the end that better control of all potato diseases may be had. Similar work is being done with cucumbers, cantaloupes, and other truck crops grown extensively along the Atlantic coast.

DISEASE-RESISTANT COTTONS.—The increase and further improvement of the wilt-resistant Upland cottons mentioned in previous reports continue to receive attention. The distribution of several hundred bushels of seed has resulted in the general introduction of these varieties into infected districts. We now have under way selections designed to be adapted for boll-weevil conditions. Special attention is called to the desirability of practicing crop rotations for the control of root-knot in the South and to supply something to take the place of the ordinary cowpeas, which must be avoided in such rotations, and wilt-resistant and root-knot-resistant varieties have been developed.

IMPROVEMENT OF CROPS BY BREEDING AND SELECTION.

WORK ON CORN IMPROVEMENT.—Gratifying results have been secured during the past year in the breeding of improved strains of corn. The breeding work has been conducted so as to cover a wide range of territory, extending from the most southern through the central and into the most northern States. As a result of the work the past three years a high-yielding strain of corn showing remarkable adaptability to dry-weather conditions has been developed in Texas. This strain has proved of value in Arizona and other parts of the Southwest.

The breeding of strains of corn for increased yield, greater uniformity, and adaptation to soil conditions in localities where grown has been continued at points in Tennessee, Virginia, Maryland, and Ohio. At all of these points the Department selections have shown their superiority to the strains commonly grown. In Virginia during the past year fields grown from one of these selections produced from 90 to 100 bushels per acre, which was about one and one-half times the average yield in the community where the crop was grown.

In Wisconsin the Department has developed a high-yielding early-maturing variety that produced last year during an unfavorable season 100 bushels to the acre.

Breeding experiments have been started the present year in California, Nevada, and Arizona to secure strains adapted to the peculiar conditions prevailing in those localities.

The work in the improvement of sweet corn has been continued, and several high-yielding strains of excellent quality have been developed as the result of work in New York, on the Arlington Experimental Farm in Virginia, and elsewhere.

SECURING NEW COTTONS BY BREEDING.—Owing to the fact that the Mexican cotton boll weevil has now invaded nearly all of the Upland long-staple section, which includes the valleys of the Mississippi and the Red rivers in Louisiana and Texas and the delta lands in Mississippi above Vicksburg, a special effort has been put forward in the matter of breeding better cottons for these weevil-infested sections. It appears evident from present experience that the fine varieties of staple cottons now used in all these regions will be practically useless when the weevil obtains a foothold. The Department has some crosses which have proved by two years' trial under weevil conditions in the Red River Valley at Shreveport, La., that they are adapted to this region.

For Texas the varieties which the Department has originated are grown in increasing acreage each year, and other new types of the very desirable native big-bolled strains are being distributed this year.

Other important cotton-breeding work has been carried on in Tennessee, South Carolina, and adjacent States.

FARMERS' COOPERATIVE BREEDING WORK.—With a view to bringing the results of the breeding investigations of the Department home to the farmer in such a way that he can adopt the practices which the Department has been perfecting, extensive cooperative work has been inaugurated in a number of Southern States. Cooperative breeding work with several types of cotton and corn was conducted with a number of farmers where the conditions were favorable for the development of new and improved varieties of these crops. Two distinct and new types of corn and six of cotton have produced such marked increase in yield per acre as to demonstrate their value for this work. These types have been adopted by the cooperators for extensive breeding work next season.

The farmers in northern Georgia have taken great interest in this work and have visited the cooperative breeding fields frequently from the time of planting the seed until the harvesting of the crop. The Georgia Cotton and Corn Breeders' Association, the members of which are for the most part cooperators, was organized in the course of this work, and held an exhibition of samples of corn and cotton at the close of the past season, where all farmers could see the results of one year's work.

Some of this cooperative work has been inaugurated in Connecticut, especially with corn, where a variety of Yellow Dent corn has been developed which has given greatly increased yields per acre in comparison with the established Flint or other varieties. In one of the cooperative breeding fields the past season, with only the usual

cultural conditions and fertilization of the soil, a measured acre yielded 133⅓ bushels of shelled corn.

Other important work in breeding has for its object the development of rust-resistant varieties of asparagus. This work is being done in cooperation with the Massachusetts experiment station. Work is also under way having for its object the development of winter oats for New England and new winter vetches and other forage crops for rotation with tobacco, corn, potatoes, etc.

SUGAR-BEET INVESTIGATIONS.

Investigations regarding sugar-beet growing have been continued during the past year along the same lines as indicated in previous reports. Special efforts have been put forward in connection with the growing of pedigreed strains of sugar beets, this work having been carried on in several States. Further comparative tests with American-grown seed and the leading varieties of imported seed have been conducted on a commercial basis with encouraging results, the amount of sugar produced per acre being somewhat greater in the case of the American-grown seed than in any of the imported varieties. The field work in the use of commercial fertilizers in connection with the growing of sugar beets is still under way. Further work is also being carried on in connection with effective cultural methods, the objects being to determine the most satisfactory depth of plowing, width of row, manner of cultivation, and other operations in connection with growing beets.

The diseases of sugar beets have received special attention during the year, and the cause of the so-called "curly-top" has been definitely determined. Leaf-spot and root-rot have been more or less destructive. Leaf-spot may be controlled by spraying with Bordeaux mixture, while root-rot may be held in check by a liberal use of air-slaked lime.

With reference to the general aspect of the sugar-beet situation it may be said that weather conditions have been more or less abnormal during the past season. Nearly all parts of the sugar-beet area suffered to some extent from lack of moisture. Notwithstanding this and the fact that other unfavorable conditions were present, the sugar beet in most instances has demonstrated its ability to withstand abnormal conditions.

PURE-SEED INVESTIGATIONS.

The pure-seed work has been extended during the past year by the establishment of testing laboratories in cooperation with the Nebraska Agricultural Experiment Station and the Missouri Agricultural Experiment Station. At the laboratory in Washington, D. C., a larger

number of samples of seed have been tested for farmers and seedsmen than in previous years. As directed by Congress, forage-plant seeds have been secured from dealers and examined for the presence of adulterants. Many lots of Kentucky bluegrass and orchard-grass seed have been found to be adulterated, but the practice of adulteration has practically ceased with other forage-plant seeds.

The efforts of this Department in encouraging the use of good seeds are being appreciated, and a reflection of this is seen in the fact that several of the larger seed houses have recently established private seed-testing laboratories. On account of the lack of instruction in technical seed testing in the agricultural colleges this Department has offered assistance along this line. So far a number of seedsmen, as well as State agricultural experiment station workers, have availed themselves of this opportunity.

SOIL BACTERIOLOGY AND WATER PURIFICATION.

Relation of bacteria to fertility.—Preliminary work has been undertaken upon the soils of the various substations of the Bureau, and extensive studies are planned for the coming year, especially in regard to the influence of the practice of summer fallowing upon the nitrate-producing power of the soil flora. Although the preliminary results are inconclusive, they indicate a higher power of nitrification in the semiarid district and a greatly reduced denitrification. It would seem, therefore, that the advantage which the eastern farmer enjoys with his moist climate is partially offset by these bacterial processes.

Distribution of bacteria for inoculating legumes.—The distribution of pure cultures of the nodule-forming organisms for legumes has been continued and with slightly better success than in previous years. Experiments have been carried on with types of soil which because of peculiar conditions prevented the growth of the proper legume bacteria and consequently made it impossible to grow leguminous crops. By the preparation of extracts of the soil and gradually adapting the nodule-forming organisms to the peculiar conditions we have been able in some cases to inoculate legumes in regions heretofore inimical to pure-culture inoculation.

Investigation of farm water supplies.—A thorough examination of over 100 farm water supplies shows that rural sanitation is dangerously bad and that in a large percentage of the cases great improvements could be made at comparatively small expense. Our investigations have also shown that cursory examinations of farm supplies are usually liable to misinterpretation and that a water supply which is in reality of great purity may be condemned, and vice versa. A thorough study of a supply renders such misinterpretation impossible.

DRUG AND POISONOUS PLANT INVESTIGATIONS.

Work on drug plants.—This work has for its object the establishment of new industries in the line of growing certain crops as drugs. In a previous report attention was called to the success attained in establishing the camphor industry in Florida. Further work has been pursued in this field, seed beds having been constructed and a considerable quantity of seedlings started for transplanting to the field. Certain regions of the South have been found particularly adapted to the production of drug and similar crops. In South Carolina, where one of the drug-crop stations is located, good success has been obtained in the production of paprika peppers. These peppers are used to a considerable extent in commerce, and the establishment of the fact that they may be successfully grown will open up possible industries and assist in a wider diversification of crops throughout the South.

Some important investigations in connection with hop growing have also been carried on during the year; also important work in the line of growing tannin crops. Closely allied with the tannin problem is that of vegetable dyes, which is receiving attention in this connection.

As a feature of drug-plant studies attention has been given during the year to matters pertaining to plants that may be used in the manufacture of industrial alcohol. The plant phase of this subject is being specially studied by the Bureau of Plant Industry, and efforts are under way having for their object the determination of when and where the utilization of plant products can be most successfully adopted for the manufacture of alcohol.

Poisonous-plant investigations.—During the past year the main emphasis has been laid on the loco-weed studies. Field studies have been continued having for their object the working out of methods of diminishing losses not requiring individual treatment. Thus far the results have not been promising. A laboratory study of the loco weed seems to show that barium is a constant constituent in loco plants which are capable of producing the disease. Feeding experiments have led to the conclusion that barium poisoning is one of the factors that has to be reckoned with in dealing with losses from loco weeds. A study of the distribution of barium in the soil and in the loco-weed flora of eastern Colorado has been begun in cooperation with the Bureau of Soils. At the request of the Forest Service special investigations were undertaken of poisonous plants growing in the National Forests. Botanical studies of the flora of the regions suspected to contain poisonous plants have been inaugurated. Plants of unknown characteristics suspected of having toxic properties are forwarded to Washington for laboratory investigation. It seems clear

that the relation of poisonous plants to the grazing interests of various parts of the country is very important and demands a thorough study.

TEA CULTURE INVESTIGATIONS.—The growing and making of tea have been gradually brought to such a position by the combined efforts of Dr. Charles U. Shepard, of Summerville, S. C., and of the agents of the Department of Agriculture that it was deemed wise to limit somewhat the scope of the part undertaken by the Department. The work involved has been reduced to a matter of machinery, except the processes of pruning and picking. A working model has been built and tested in the tea gardens at Summerville, with promise of complete success. The crop of tea there is reported about the same as last year, viz, 10,000 pounds, but owing to more careful picking it has an even higher quality than heretofore.

CROP TECHNOLOGY.

A number of important lines of investigation recently inaugurated by the Department have, owing to their close relationships, been grouped under the general head of crop technology. Certain important biological studies of grains come within this category; also the new work authorized by Congress on cotton standardization and fiber investigations.

BIOLOGICAL STUDIES OF GRAINS.—In the biological studies of grains progress has been made in interpreting the terms of the original so-called analysis into biological equivalents. An increased number of investigators are turning their attention to the problems opened up in this direction, and the results obtained have found their way to the public through various important channels during the year. In all the biological studies of grain the utility of the facts discovered is considered in connection with the subject of grain grading, as well as with that of breeding, milling, and baking. In other words, these biological studies have for their primary object the securing of data which will be valuable in future work on breeding, on milling, and on baking.

COTTON STANDARDIZATION.—The subject of cotton standardization has received careful attention ever since the agricultural committees of Congress first began to give the matter consideration. Good progress has been made toward establishing the nine official standards directed by Congress. The different American and foreign cotton exchanges have responded generously to an invitation to assist in this important matter. These numerous exchanges have contributed their standards free of cost, thus insuring an extensive collection as data for the establishment of official grades. The work undertaken

in connection with this important project gives full consideration to all the problems involved in the raising, picking, ginning, baling, warehousing, grading, pressing, shipping, and spinning of cotton, and at a later date it is confidently expected that the official standards will be elaborated without alteration of their fundamental character, so as to be much more useful than any standards have ever been in the past. The possibility can now be clearly seen, through technical examination of the cotton fiber of this country, of so improving cotton classification that all interested in the cotton industry will be materially benefited. Careful studies have been made of the baling and handling of cotton, and a bulletin on the subject has been prepared. The present methods of baling and handling entail an annual loss of millions of dollars. The investigations along this line, together with the adoption of uniform grades, should result in great improvement.

Paper manufacture.—With reference to the paper work, under special authority given by the last Congress a comprehensive series of tests is being undertaken in conjunction with the Forest Service and the Bureau of Chemistry, the object being to ascertain whether or not the fibrous portions of various crops can not be more generally utilized in the manufacture of paper. In this series of tests corn, rice, and flax are receiving prominent attention. It is too early to make a full statement, but the results already obtained are regarded as promising.

TRUCK-CROP INVESTIGATIONS.

The inauguration of extensive fertilizer tests in the trucking regions of Long Island and Virginia has an important bearing upon the commercial end of the trucking business. The cost of fertilizers is the largest single item of expense aside from labor entering into the production of truck crops. The work to date indicates that two important results will follow the more judicious use of commercial fertilizers: (1) Better crop rotation and consequent soil improvement, and (2) a greatly reduced expenditure for commercial manures, together with better development in crops. The lack of humus in the soil and the excessive use of high-grade chemical fertilizers are responsible in certain seasons for decided crop shortages which improved practices easily overcome.

FRUIT INVESTIGATIONS.

Important work in connection with the pomological collections and other investigations of this nature has been carried on during the year. The Department receives many hundreds of requests for help, all of which are cheerfully met. The identification of fruits and the resulting correspondence occupy a great deal of time. More than

2,500 specimens of fruits were received for identification, including rare and little-known fruits from recently annexed island possessions. More than 50 varieties of fruits were disseminated to fruit growers and horticulturists for trial during the year.

FRUIT MARKETING.—The investigation of the problems involved in the marketing, transportation, and storage of fruits has continued during the year, the work being shaped to conform to the rather abnormal crop conditions that prevailed during the season of 1907. Notwithstanding the low quality of the winter apples throughout most of the eastern apple districts, the export movement was heavy, and under existing market conditions again demonstrated its importance to the apple industry by affording an outlet for surplus supplies. The season's experience resulted in a renewed interest among growers and shippers in the subject of grading and packing winter apples.

HANDLING AND SHIPPING CALIFORNIA ORANGES.—The work on orange handling in California was vigorously prosecuted along lines previously discussed, with a view to accumulating sufficient data under varying conditions to permit safe generalization. In this work nearly 300 experimental shipments from California to the Atlantic coast were made in cooperation with individual orange growers and cooperative associations to determine the influence of different methods of handling upon the behavior of the fruit while in transit and after its exposure in the market. The results of this work in connection with that of former years establish conclusively that it is practicable to handle the orange so carefully on a large scale that decay in transit and for a reasonable time after arrival in our eastern markets can be practically eliminated.

Tests of various fungicides that have been suggested for preventing the mold decays by dipping the fruit therein failed to reveal any efficient agent of this character.

The influence of these investigations on the orange industry in southern California is already strongly evident. A general reorganization of methods of handling labor in the groves and houses, as well as a readjustment and remodeling of many of the packing houses, has made possible a marked improvement in the handling of the fruit, with a resulting reduction of two-thirds in the losses due to decay, which formerly amounted to from \$750,000 to \$1,500,000 per annum.

FLORIDA ORANGE WORK.—The results of the work on orange handling in Florida, which has followed the general lines developed in California, indicated that the need of careful handling and prompt shipment after harvesting of the fruit from that State is even greater than with California fruit. The indications are that the losses there,

which amount to a half million dollars a year, can to a considerable extent be overcome by handling the fruit with sufficient care to avoid mechanical injury. The work is receiving hearty cooperation from the growers and shippers of the State.

Fruit storage.—Comprehensive tests of the behavior of apples in storage from different producing sections in New York, Iowa, Colorado, and California have been continued with a view to determining the best methods of handling the fruit to insure the longest keeping in sound and wholesome condition. Strikingly important results have been obtained in the storage of a number of varieties of table grapes in California, which it has been found possible to hold from sixty-five to one hundred days in excellent condition when packed in fine ground cork, where similar fruit packed in the ordinary commercial way could be held but from ten to twenty days. The possibility of displacing the present large importation of foreign grapes for winter use with fresher fruit of better quality and of American production renders this work of special importance to American grape growers.

Viticultural investigations.—The cooperative vineyards on the Pacific coast, established primarily for the purpose of determining the adaptability of resistant stocks to vineyard soils and the congeniality of the leading varieties to such stocks, have reached a point where they may be expected to yield important results along those lines. Comprehensive work on the discovery and development of improved varieties of the Rotundifolia type of grape, of which the Scuppernong of the South Atlantic States is the best known, is also well under way.

Adaptability of fruit varieties.—The principal study of the adaptability of fruit varieties to soil and climatic conditions has been in the Ozark region of Missouri, Arkansas, and Oklahoma, a special study of early apple varieties in the Middle Atlantic States having been completed. Types and varieties adapted to the needs of farmers and ranchers in the semiarid regions of the Great Plains area and the best methods of handling them are being studied in a dry-land fruit garden at Akron, Colo.

Pecan culture.—Comprehensive studies of the adaptability and relative value of pecan varieties in the Southern States have been commenced, many problems requiring attention having come to light in connection with this rapidly developing new industry.

Domestication of the blueberry.—One of the most delicious and popular small fruits is the blueberry. The whole market supply comes from wild bushes. Various attempts have been made to cultivate the blueberry, but without commercial success. In the hands of a few horticulturists the bushes are fairly successful as ornamental

plants, but they fruit sparingly. An investigation of the blueberry has been in progress in the Department for the past two years, and a partial knowledge of the facts essential to an understanding of the cultural requirements of the plant has been acquired. It has been discovered that on its roots grows a fungus, and that this fungus is beneficial to the plant, the vigor of the plant being directly proportional to the amount of the fungus borne upon its roots. The blueberry grows best in acid soils rich in humus and organic matter but poor in available nitrogen. It is now believed that the special function of the fungus is to assimilate nitrogen, either from the decaying leaves in the soil or from the atmosphere, or from both, and to carry it to the roots. Experiments to ascertain the exact physiological operations of the fungus are now under way, and practical tests are being made to work out the conditions under which the plant may be domesticated and grown.

THE PASTURING OF RANGE SHEEP IN COYOTE-PROOF INCLOSURES.

An experiment in the pasturing, as opposed to the herding, of range sheep has been in operation during the past season, conducted jointly by the Forest Service and the Bureau of Plant Industry. The results of the experiment are of great significance in their bearing on the increase of the carrying capacity of the great sheep ranges in the Western States and on the improvement of range mutton and wool in amount and quality.

The experiment was located at Billy Meadows, in the Wallowa National Forest in northeastern Oregon, a district infested with coyotes and other wild animals. An area of 2,560 acres of mixed forest and grass land was inclosed with 8 miles of woven and barbed wire fence believed to be coyote-proof. The inclosure was cleared of coyotes in the spring and a band of ewes and lambs numbering 2,209 was turned loose within it. They were not herded, but were left entirely free to make their own choice of feed, watering places, and bed grounds.

The experiment was a success in every way. Although coyotes came up to the outside of the fence nearly every night during the summer, not one of them succeeded in entering the inclosure. The sheep spent the whole season in almost absolute quiet, without any molestation by wild animals. The deaths among the sheep from all causes amounted to only one-half of 1 per cent, and none of this loss was from wild animals. In three bands on the outside range immediately adjoining the pasture the losses during the same period were 3 per cent, chiefly due to animals.

Still more significant was the condition of the sheep at the end of the season. The pastured band was made up of original Merino stock bred for six years to Rambouillet bucks. The sheep were there-

fore of a pure fine-wool type. The average weight of the lambs at the age of 6 months was 72 pounds. Individual lambs weighed 90 pounds. In the unfenced range immediately adjoining the pasture a band of sheep of similar class and grade was grazed during the season under the customary herding system. This range was exactly similar to that in the pasture and had the advantage of being a little less heavily stocked. The lambs of this band averaged 62 pounds, 10 pounds less than the pastured lambs. The heaviest herded band of fine-wool sheep accessible for comparison had lambs averaging 64 pounds, and they had grazed during the summer on a range richer than that in the pasture. Even half-Shropshire lambs from Merino and Rambouillet ewes when herded failed to weigh as much as the pastured fine wools, the half-Shropshire lambs in the four herded bands used for comparison averaging 63, 64, 65, and 69 pounds, respectively.

In the matter of carrying capacity a still greater economy was effected. A comparison of the pasture with the ranges of five bands immediately surrounding it indicates that the carrying capacity of the land was increased 50 per cent, at a conservative estimate, by the pasture system.

The excessive cost of the fence—$854.54 per mile—was due in part to special items of expense, such as $1,037.46 for hauling wire from the railroad, $1,150.87 for clearing timber from the fence line, and the high cost of labor, $3 a day. Under ordinary conditions the fence can be constructed for $500 per mile.

The system is applicable with much greater economy to lands outside the National Forests and at lower elevations. Under suitable conditions, in such situations, a fence of this kind will pay for itself in a few years. If our land laws were such that the system could be applied to the whole of the remaining public sheep range, the product of these lands in wool and mutton, it is confidently believed, would be doubled.

GRAIN STANDARDIZATION.

Since the publication of my last annual report an unusual development has taken place in the work of grain standardization. The results already accomplished have been of value in bringing about a better understanding concerning the value of the various factors which are taken into consideration in determining the grade of any given lot of commercial grain, and have led to the formulation of more definite and satisfactory rules on grades in many of the markets.

GRAIN STANDARDIZATION LABORATORIES.—Seven laboratories are now maintained outside of Washington, one at each of the following grain centers: Baltimore, Md., New Orleans, La., New York, N. Y., Duluth, Minn., Minneapolis, Minn., Chicago, Ill., and St. Louis, Mo. Numer-

ous requests for the establishment of laboratories in other important grain markets have been received, but the limited funds available for this work rendered the opening of additional laboratories impossible; consequently the work has been limited to the primary markets, embodying the widest range of conditions and showing the greatest variation in the kinds and classes of grain handled. In each of the laboratories now in operation the work consists principally in determining the moisture content and in making mechanical analyses of samples of grain submitted by grain inspectors and merchants, and in carrying on such special investigations in cooperation with the research laboratory which is maintained in Washington as will furnish data of value in adjusting the unsatisfactory conditions now existing in the grain trade throughout the United States. The moisture test is most frequently called for, and large quantities of corn are now handled on a definite percentage statement of moisture content. A number of cases have been reported in which the results of the analyses furnished by the laboratories have determined the action taken in appeals and otherwise served in the satisfactory adjustment of grades.

Grain transportation and storage investigations.—Within the past year some preliminary investigations were made on the changes which take place in grain while in storage and during shipment from country points to primary markets or to the seaboard. These investigations will be carried on more in detail during the coming year, giving special attention to the causes of the deterioration of corn during transit from the central part of the corn belt to the seaboard and thence to European ports.

Milling and baking value of wheat.—Not having the proper milling facilities in the Bureau, arrangements have been made with the North Dakota Agricultural Experiment Station for cooperative investigations during the coming year whereby a limited number of commercial classes and grades of wheat can be properly tested as to their milling and baking value. Milling and baking tests are matters of fundamental importance in connection with the investigations of the Bureau, in that standards for wheat grades are dependent almost solely on the quality and quantity of bread which can be produced from the flour, and I respectfully call the attention of Congress to the need of sufficient funds for the installation and maintenance of a fully equipped experimental flour mill.

Investigations at European ports.—Of recent years many complaints have been received from European grain merchants concerning the badly damaged condition in which much American grain arrives at European ports. During the past year experts of the Bureau of Plant Industry have made a special study of the condition

and quality of American-shipped grain at the time of its discharge at European ports. These investigations have shown that the reports of our consuls have been very conservative and that the complaints of the European grain receivers are well founded. As in similar investigations during previous years a number of cargoes of corn were examined, and the grain in some of the holds was found to be hot and in a badly damaged condition, even though it carried a certificate of No. 2 Prime Sail. The dissatisfaction on the part of foreign dealers has become extremely acute, and it is evident that if conditions do not show improvement our export grain trade will be seriously affected.

Inspecting and grading commercial grain.—While many of the influential grain dealers of the country are working hard to bring about a more satisfactory and uniform system of inspecting and grading grain in the various markets, it is believed, as stated in my last annual report, that the end to be attained can be brought about only through National inspection of all grain entering into interstate and foreign commerce.

Measuring moisture content by electricity.—As a result of work conducted by the Bureau, an electrical method for the rapid measurement of the moisture content of grain, requiring only two or three minutes for a determination, has recently been devised. This method can be used in cars and elevators and will doubtless prove of great value in connection with the grading of grain.

DRY-LAND AGRICULTURE.

This important work, inaugurated several years ago by the Bureau of Plant Industry, is being pushed as rapidly as the means at hand will permit. The work covers three principal areas: (1) The Great Plains region; (2) the southwestern section, including the dry portions of Texas, New Mexico, Arizona, and California; and (3) the intermountain region, including the Great Basin of Utah and the arid lands which can not be irrigated throughout the mountain States of the West. A number of the branches of the Bureau are contributing to the work and all are in close cooperation.

Stations for the investigation of dry-land conditions.—Eleven stations have been established in the Great Plains area where carefully planned scientific investigations are being carried on to determine the best methods of tillage, rotation, and crop sequence. Seven of these stations are in cooperation with the State experiment stations of Montana, North Dakota, Nebraska, and Kansas. Four of them are not in cooperation with the State experiment stations and are located in South Dakota, Colorado, and Texas. The actual field investigations are under the immediate supervision of a corps of

trained specialists who are familiar with local conditions and farm practices, as well as the scientific problems involved. While the nature of these investigations is such that they must necessarily require a continuance for a long term of years to obtain the most satisfactory results, the information already obtained has proved of great value in giving advice and assistance to actual and prospective settlers upon the semiarid lands. It is the first time any systematic attempt has been made to secure definite facts which, it is believed, will eventually form the basis of agricultural practice throughout the area mentioned.

General work in the semiarid sections.—In addition to the various lines of work which have already been mentioned under their respective heads as being conducted in the western portions of the country, the Department is now actively engaged in the following projects having for their object the aiding of farmers in the arid and semiarid portions of the West: The introduction and testing of new drought-resistant corns from Central America and new cottons from the same region; the extension of drought-resistant cereal and grain crops of various kinds into all parts of the semiarid belt; the development of dry-land orchard fruits, including dry-land olive culture; the extension of sugar-beet culture; the utilization of native plants, such as the cactus; and numerous other lines of work.

FARM MANAGEMENT.

The work which has now been carried on for several years under the general head of "Farm Management" is growing in importance and value. Its object, as previously explained, is to bring together and carry to the man on the land the best knowledge of how to make agriculture more profitable and at the same time conserve or build up the fertility of the soil. Research and experiments are not a part of this work, but the results secured in this field by the Department and the experiment stations are applied. The work is distinct from that of cooperative farm demonstrations, as explained under another heading, in that the class of farmers dealt with have, owing to more fortunate surroundings, been placed in a position to undertake advanced lines in the general improvement of agricultural practices.

Work in the South.—The continued clean cultivation of cotton and corn in the South has destroyed the humus of the soil. Special attention has been given to methods of supplying humus. Improved systems of crop rotation and general farm management are being outlined and put into practice by many farmers who are cooperating in a very cordial way with the Department. Crops which have been secured by other branches of the Department are called to the atten-

tion of reliable men who are willing to test and try them, and in this way various cereals, forage crops, etc., have been quite generally extended. In handling work of this kind every important factor which may bear on the successful production and handling of the crop must be taken into consideration. Alfalfa is being advocated in a number of sections with excellent results.

New England systems of farming.—In the Northeastern States it is becoming more and more important to shift the systems of farm management and general cropping systems to the end of meeting the increasing prices for concentrated feeds. The primary object of this work is to outline and secure the adoption of cropping systems which will result in the production of large quantities of protein on the farm, making it practicable to omit to a considerable extent the purchase of the higher-priced feeds.

Work in the Middle West.—The continued advance in the price of land is having a marked effect on the systems of farming. In addition, the exhaustion of the soil under exploitive systems of farming has brought about radical changes. A special line of work conducted during the year has for its object the investigation of the possibilities of introducing successful agriculture in the jack-pine plains of Wisconsin, Michigan, and Minnesota. These lands are wild and sandy, and under ordinary methods of cropping are not profitable. Certain systems of farming, involving the growing of clover for seed, are found profitable in the region. A bulletin outlining this important line of work has been published.

Work in the Plains Region.—With a view to rendering assistance to the many people who are giving up their farms in the more humid regions and securing cheaper lands in the dry sections of the West, studies of successful farms in these drier regions are being made. During the present year the Department has been making a careful study of the experience of a number of farmers who have remained on the land since the first settlement a generation ago. Some of them have worked out satisfactory methods of farming in regions where farming generally has not been successful. The experience of these men will be brought together and published in the near future for the benefit of others who are trying to make a living under these adverse conditions.

The Bureau, in addition to the line of work already indicated, is engaged in some special studies having to do with fertilizer practice; in important studies of some rare forage crops which may possibly be suitable for the South, such as cassava, in some highly important investigations of the weed problem and its bearing on farm management; and also in studies involving the utilization of the cactus, which

now grows so extensively in our southwestern regions, as a forage crop. The value of cactus has been fully demonstrated and the details of its cultivation are now being worked out.

RELATION OF FARM MANAGEMENT TO SOIL SURVEYS.—As pointed out elsewhere in this report, important changes have been made in the matter of soil surveys. The regional and detail surveys now being made will, it is believed, form a useful basis for studies of farm practice not only by this Department, but by station workers as well. It is planned to follow up the work now being done, especially in the Great Plains area, to the end of utilizing the soil factors as developed by the survey in the general aid of farmers in the region. In all this work it is recognized that the successful production and disposal of the crop in any region are influenced by many factors. The factors themselves and their relationships must be studied before intelligent advice can be given to the farmer.

FARMERS' COOPERATIVE DEMONSTRATION WORK.

The object of the farmers' cooperative demonstration work now being carried on in the South by Dr. S. A. Knapp is to place a practical object lesson before the farmer, illustrating the best and most profitable method of producing the standard farm crops and to secure active participation in such demonstrations by the farmers themselves. It is an effort to teach the farmer to help himself through the influence of good local assistance, aided and guided by such means as the Department may find it necessary to supply.

The practical value of the work can be estimated by its growth. Congress has made a yearly appropriation for its maintenance in the States where the Mexican cotton boll weevil is present, and the General Education Board of New York, being impressed with the results, asked to cooperate with the Bureau in extending the work east of the Mississippi. Beginning in 1906, this Board has supported the eastern or "extension division" of the work, which includes the cotton States from Mississippi to Virginia, by an appropriation annually increased till the sum of $76,500 has been allowed for the year 1908–9. From one farm in Texas and one agent in 1903 the work expanded in 1908 to 32,000 farms with 157 field agents, covering portions of 11 States from Texas to Virginia, inclusive. In numerous cases, when appeals were made for greater extension of the work and there were not sufficient available funds to meet the added expense, counties or business organizations have cooperated in paying half or more of the salary of an agent. As organized under the Bureau of Plant Industry, its working forces consist of 1 director, with assistants, 10 State agents, and 147 district and local agents. Weekly reports are made by all agents to the director, showing work accomplished each day.

It is stated to the farmers that they can increase their crop yields two, three, or four fold at a reduced cost per acre, and that this may be almost a net gain by producing upon the farms the food supplies for family and teams. They are asked to prove it by working an acre or more according to directions. The necessary work on this part of the farm must be done by the farmer and not by a Government agent, because the whole object lesson is thereby brought closer to the people. The demonstrating farmer understands it better because he does the work. His neighbors believe that what he has done they can do. The agent makes monthly inspections of fields and gives additional instruction.

COOPERATIVE WORK.

The Bureau of Plant Industry has a great deal of cooperative work under way. Cooperation is carried on with practically all of the State experiment stations. The Bureau is also cooperating with the Forest Service, the Bureau of Chemistry, the Bureau of Soils, and other branches of the Department. Important cooperative arrangements have been established with the Office of Indian Affairs, and through the cordial support of that Office there has been secured a 55-acre testing and demonstration tract at Sacaton, Ariz., on the Pima Reservation. This station is now doing some most excellent work and is being thoroughly equipped for the same through the courtesy of the Indian Office.

In order to promote the successful development of the new projects put under irrigation by the Reclamation Service, this Department has started experimental work on several projects in the Western States. On three of these projects small experiment farms have been established during the past two years. The use of the necessary land, water, and permanent equipment for these farms is furnished by the Reclamation Service, and the experimental and demonstrational work is carried on by this Department. The aim of these experimental farms is to secure thorough and careful trial of new plants that are introduced by the Department, to ascertain and demonstrate the tillage and irrigation methods best suited to each locality, and to provide a place for the special investigators of the Department to carry on field experiments along their particular lines. As an instance of the value of these farms in the introduction and establishment of new crops there may be noted the case of Egyptian cotton in the Southwest, an account of which is given on page 44.

WORK ON GARDENS AND GROUNDS.

The care of the gardens and grounds surrounding the buildings of the Department proper has, as heretofore, been made a feature of the work of the Bureau of Plant Industry. Our physiological, pathological, and horticultural houses are now well grouped and

well provided with facilities for conducting the wide range of investigations made necessary by the different laboratories in the Bureau. During the year two new greenhouses have been erected and are devoted largely to experimental work. Owing to changes in buildings of the Department it has been necessary to shift a considerable portion of the work formerly conducted on the southern portion of the grounds to the houses on the north side. A large number of plants have been received, propagated, and distributed during the year. Special efforts have been put forward toward the ornamentation of the grounds and the development of an interest in horticulture through means of flower shows, special plantings, etc.

ARLINGTON EXPERIMENTAL FARM.

The plan of soil improvement adopted in the management of the Arlington Experimental Farm is proving to be more effective than was anticipated. The work forcibly demonstrates the value of cowpeas and crimson clover as soil enrichers. The nitrogen gathered by these crops, together with the mechanical benefits obtained from turning under large quantities of organic matter, has transformed a cold, inert, and unproductive soil into one which is loose, friable, and productive. This work is of great value, because it demonstrates the method which any land holder in the South Atlantic States may follow to restore high productive power in his soil at small cost.

CONGRESSIONAL SEED DISTRIBUTION.

The Congressional distribution of seeds and plants was carried out along the same general lines as in previous years. The regular distribution of standard varieties of vegetable and flower seeds was made, and the cooperative distribution of selected varieties of cotton, tobacco, and other seeds developed by the Department was carried on with gratifying results. The work of packeting and mailing vegetable and flower seeds was seriously interrupted in November, 1907, by the almost complete destruction by fire of our seed warehouse. Congress promptly appropriated a sum sufficient to cover the loss, however, and the work was resumed about January 1, 1908, in temporary quarters. All of the vegetable and flower seed was distributed in ample time for spring planting in the various parts of the country, although the fire resulted in delaying the final shipments about one month beyond the usual time for completing the distribution.

FOREST SERVICE.

PROGRESS IN NATIONAL FOREST ADMINISTRATION.

Mastery by the Forest Service of one of the greatest practical forest problems ever undertaken by any Government is advancing apace. Briefly stated, that problem is to develop to its highest usefulness a

total area of 168,000,000 acres of wild lands, mainly mountain wilderness, but closely related to the welfare of the entire West, and therefore of the entire country. The progress of the year was marked along both administrative and technical lines.

From an administrative standpoint the most striking fact of the year was the remarkable increase which took place in the volume of business transacted, or, in other words, in the actual use of the Forests by the public. This increase is partly brought out by the following statement:

	Per cent.
Increase in area	11
Increase in number of timber sales	236
Increase in amount of timber cut	102
Increase in number of free-timber permits	76
Increase in number of special-use permits	67
Increase in number of grazing permits	11

The growth in the volume of business arising from use of the Forests has created a very serious administrative problem. Last year 78 per cent of the time of the administrative and protective force was taken up by the demands of National Forest business. The average forest area to each officer supposedly available for patrol duty was about 120,000 acres; but with more than three-fourths of the time of these officers occupied with timber-sale, grazing, and other business, the force actually available for patrol was equivalent to about one man to each 500,000 acres. That under these circumstances the fire losses in a year of exceptional danger were kept down to a very small figure in comparison with the value of the timber exposed and the damage from forest fires elsewhere is a matter of congratulation.

The risk incurred, however, is out of all proportion to the added cost which more adequate protection would involve. With the further growth in business which is certain to take place during the present year, even less protection can be given than has been given in the past. Indeed, the point has now nearly been reached at which it is not even a choice between providing for the needs of those who would use the Forests and protecting the Forests themselves. Were the entire energies of the administrative force to be given to business which use of the Forests involves, it would soon be necessary to curtail use from inability to handle the business with the means available.

Regarded as property, the National Forests justify liberal expenditures for their protection and improvement. At $2 per thousand feet stumpage, the merchantable timber alone forms, just as it stands, an asset worth something like $800,000,000, while the very moderate grazing charge yielded the Government last year an income of nearly $1,000,000. It is a safe prediction that within twenty years the Forests will bring in from the sale of timber alone an annual net income of as many millions of dollars.

An average wood production of 30 cubic feet to the acre of commercial forest is a moderate estimate of what will ultimately be obtained under management. One hundred million acres of such forest would allow to be cut each year over 3,000,000,000 cubic feet, or from 20,000,000,000 to 25,000,000,000 board feet, without diminution of the supply. This is but a fraction of the country's consumption of wood at the present time, but at the stumpage prices which already obtain in the older and better settled parts of the United States its sale would bring the Government each year from $80,000,000 to $125,000,000.

It is true that both the total and the per acre expenditures upon the Forests last year were greater than in former years, but the increase in the cost of administration was far less than that in the volume of business. Including an expenditure of about $600,000 for permanent improvements, there was spent on the National Forests in the fiscal year 1908 over $3,100,000 out of total expenditures by the Service of $3,400,000, as against about $1,500,000 out of a total of $1,900,000 in 1907 and about $1,000,000 in 1906. The executive and protective force at the close of the year numbered 1,362, as against 1,245 for 1907 and 858 for 1906. The area of the Forests was at the close of the year about 168,000,000 acres, as against 151,000,000 acres at the close of 1907 and 107,000,000 acres at the close of 1906. On this basis the expenditures per acre for the three years were 18, 10, and 9 mills.

These figures, however, partly disguise the facts. In the first place the great increase in acreage which took place during 1907 was principally in the latter part of the year. Again, the expenditures for 1908 include those for permanent improvements, which are not properly chargeable as a part of the cost of administration and protection. The same is true of the heavy outlays for field equipment, instruments, furniture for new supervisors' offices, and similar articles, necessitated by the increase in the area of the Forests.

Nevertheless, it remains true that the per acre cost of administration was higher in 1908 than in previous years, principally because of the increase in business to be transacted, but the percentage of increase in this cost was much smaller than the percentage of increase in the volume of business handled.

The increase in expenditures was made possible by the agricultural appropriation act of 1907, under which the Forest Service received for 1908 $2,385,765.71, and by the existence of a surplus of $1,172,922.36 derived from receipts from the National Forests before July 1, 1907, and therefore available for expenditure during the fiscal year 1908. In the year 1907 $908,328.66 was expended from the receipts, which amounted for the year to $1,571,059.44, but there was carried forward from the receipts of the previous year a balance of $510,191.58, thus making up the surplus stated above.

Since the receipts from National Forests are no longer available for the expenses of their administration, the sole support of the Service during the year 1909 is the appropriation carried by the agricultural appropriation act of 1908, amounting to $3,896,200. This compares with a total sum of $3,558,688.27 available in 1908, or an increase of less than 10 per cent. Since the area of the Forests at the beginning of the fiscal year 1909 was greater by about 11 per cent than at the beginning of 1908, the per acre expenditure provided for is slightly less than in 1908. With the growth in use which is taking place there is every reason to fear that it will be impossible to supply facilities for the prompt transaction of business, and there is absolute certainty that efficient protection of the Forests can not be given. I am convinced that the provision made for the care and use of the National Forests has become inadequate to their needs, and I have therefore submitted estimates for the fiscal year 1910 which ask for a substantial increase in the appropriation.

WHY EXPENDITURES EXCEED RECEIPTS.

Were it wise to do so, the receipts from the Forests could very easily be made not only to keep pace with the expenditures, but to return to the Government the entire cost of maintaining the Forest Service. Private owners of grazing lands in the same regions ask and receive a very much higher return per head of stock for the use of their lands than does the Forest Service. The National Forests, which contain one-fifth of the standing merchantable timber in the country, furnished last year about 1.3 per cent of its lumber cut, resulting in the removal from the Forests of about one-eighth of 1 per cent of the stand. Of this comparatively insignificant amount cut, one-fourth was not sold, but was given to home builders and communities; yet the sales brought in nearly $900,000. If the chief object of the Forests were to produce immediate income, the amount received could be multiplied several times. There is actually going to waste in the woods each year, through decay and other natural causes, from five to ten times the amount of timber now being cut.

With an adequate force of Forest officers available much of this waste might be prevented. Timber sales involve, for marking, scaling, and supervising the work, a cost to the Government of about 30 cents per thousand feet, and the amount sold can not be much increased without an increased appropriation. There is also the waste of the productive power of the Forest, which can not be brought into full play until the mature trees have been removed to make room for a growing crop.

Yet other considerations are involved. Most of the National Forest timber is beyond reach unless heavy outlays are made to obtain means of transportation. Such timber can be sold only to those who

command large resources of capital, and even then only at a relatively low price. On the other hand, where the demand for the timber is good and competition for its purchase fairly brisk, it is generally necessary to go slowly because of the certainty of future requirements. In short, the question of the timber that can safely or wisely be sold is a local one. The fact that timber is rotting in the woods in distant regions will not help communities which find their home supply exhausted.

For these reasons the sales of National Forest timber are carefully guarded. In consequence the receipts have for the time being lagged behind the expenditures. In 1907 the Forests brought in more than was spent upon them. In 1908 the expenditures exceeded the receipts by more than $1,200,000. The difference in the showing of the two years is a result of the recognized necessity of considering future needs in preference to immediate revenue. That the country may have timber when it will want it most, the Government is virtually investing the difference between the receipts and the expenditures, for it is not merely protecting the present merchantable timber from loss by fire, but is also increasing the stock of young trees which will make up the future Forest supply.

I am now restricting the sale of timber from the National Forests in accordance with a policy dictated by the public interest. The timber lands of the West, outside of the National Forests, are mainly in strong hands. Were the National Forest timber offered on the market to every purchaser, the main scene of western lumbering would be quickly shifted to the public holdings. It is sometimes asserted that the creation of the National Forests has played into the hands of monopolists of timber lands. It was, on the contrary, an eleventh-hour halting of the process which would soon have made the hold obtainable by such a monopoly complete. To permit the owners of standing timber to preserve their stumpage intact while supplying their business needs through purchases from the Government would simply invite the hoarding of private timber for further high prices, while the public supply would be disposed of without an adequate return.

Under the timber-sale policy now in force both the present and the future interests of the consumer are borne in mind. The needs of those dependent on the Forests are supplied up to the limit set by the power of the region to maintain a steady yield. It is recognized, also, that the removal of mature timber to make room for a new and growing crop is the only way by which the Forests can be put to work. Small sales are, however, preferred to large sales; and large sales which would tend to expose the consumer to monopoly prices are uniformly refused. Requests made by prospective bidders for the

advertising of over $2,400,000 worth of timber were refused during the past year.

One result of this policy has been to bring about a decline in the average price of stumpage sold. In general, higher prices are obtainable through large than through small sales. The most important consideration in making sales of timber, however, is not the price obtainable, but the serving of the public interest. Obviously, to sell timber in quantity at less than the market price through any other method than competitive bids would simply work to the profit of specially favored individuals; but care must be taken at the same time both to prevent local consumers from being overcharged by those who buy stumpage from the Government, and to prevent the exaction of a monopoly price for stumpage by the Government.

PERMANENT IMPROVEMENTS.

The agricultural appropriation act of 1908 included an item of $500,000, which was made available for permanent improvement work on the National Forests. The object of this work is to help open up the Forests to more use and provide means for their better and more economical protection, through the supply of means of communication and transportation, well-located field quarters, fire lines, fences to assist in the handling of stock, and watering places. These improvements are essentially investments of capital, which add greatly to the value and usefulness of the Forests.

The work completed during the year included 3,400 miles of trails, 3,200 miles of telephone line, 100 miles of wagon road, 40 miles of fire line, 250 bridges, 550 cabins and barns, and 600 miles of pasture and drift fences. In addition to the sum provided by the special-improvement fund, over $100,000 from the general fund of the Service was turned from current expenses to defray the cost of this work, but much of the work planned and urgently needed could not be carried out because there was nothing with which to pay for it.

Detailed estimates covering a total of $2,000,000 for permanent improvements, which it was desired to complete in 1909, were submitted to the Congress. They showed for the entire amount exactly what it was proposed to undertake on each National Forest, and at what cost. The amount provided by the appropriation was $600,000. For 1910 estimates will again be submitted for permanent improvements, the cost of which aggregate $974,981. These estimates are the result of specific and fully itemized plans, which are on file in the Forest Service. They are in no sense a request for a lump sum, the spending of which remains to be planned in detail after appropriation is made. It is of urgent importance that this work should be provided for.

Though the construction of permanent improvements entails the need of provision for their maintenance, the added efficiency of the Forests as economic resources secured through these improvements richly repays the cost. With the National Forests as with any other resource, their returns depend on the extent to which development takes place through judicious outlays of capital. If the land is not to remain a wilderness it must be made serviceable to the needs of civilized man by constructive expenditures.

THE ADVANCE IN TECHNICAL METHODS.

Through the cutting of timber on National Forests the actual practice of forestry is being put into effect by the Forest Service on an extensive scale. The end sought is, of course, the largest permanent supply of economic needs which the application of expert knowledge to a technical problem can bring about. With the best intentions, plans to make the most of a great productive resource will miscarry unless foresight is supplemented by practical experience and an actual command of good methods.

When the Forest Service undertook the management of the Forests it confronted a problem of first-class magnitude and extraordinary difficulty. Scientific knowledge in the light of which the work should be directed had to be gathered while the work itself went on, for there was no way to learn how to manage American timber lands most effectively except by managing them. The practice of forestry on the Government's holdings was better during the past year than ever before.

The direction in which improvement was most marked was, naturally, in closer adjustment of methods to local conditions, through modifications of general rules of practice to fit the individual case. In forestry, as in agriculture, the best results require intensive methods. Though nothing approaching intensive management of the National Forests has yet been reached or can be reached without a very great increase in the technical and executive force, progress toward such management is being made at a very gratifying rate.

All timber to be cut is marked beforehand by the Forest officers. The efficiency of this work depends on the wisdom with which rules for marking are laid down and the skill with which they are applied. In both respects the work of the year bettered previous practice. Special marking rules for each National Forest were prepared and put in force. Where it was found that a shortage of the supply of timber for meeting local needs is to be feared, the marking system was modified to provide for the cutting only of trees which have made their full growth or are dying or diseased. Thus, the thriftier merchantable trees are left for a second cut from the same area

within fifteen or twenty years. The selection of seed trees was improved, more complete use of the timber felled was secured, and more dead and low-grade timber was sold. In these and many other ways the standard of technical work on the Forests was raised.

The fire record also deserves mention. Since the fiscal year ends in the midst of the fire season, reports of fires are made not for fiscal but for calendar years. During the calendar year 1907 the loss of timber by fire was less than half that of the previous year, though this in turn was less than ever before. About one-seventh of 1 per cent of the Forests was burned over in 1907, with a damage so slight as to be practically negligible. The ratio of loss to the value of the timber protected, allowing that it is worth $2 per thousand feet, was about as 4 cents to $1,000. The entire cost of National Forest administration was equivalent to a charge of one-third of 1 per cent on the value of the timber protected—surely a cheap insurance rate.

This immunity from fires must be ascribed chiefly to the results of the consistent efforts made in the past to inform the public as to the danger of carelessness in the use of fires in the Forest and to the recognized necessity of vigilance to put out small fires. With reasonable cooperation on the part of the public to prevent fires and reasonable provision for discovering and fighting fires when they start, really heavy losses are entirely preventable. The widespread forest fires of recent months are a case in point. Relatively little damage was done to the National Forests at a time when the air was thick with smoke almost from the Atlantic to the Pacific coast, and most of the National Forest loss which was suffered, amounting to perhaps $1,000,000, was due solely to the fact that the area to be protected is so vastly out of proportion to the resources at the disposal of the Forest Service.

THE NEED OF PRIVATE FORESTRY.

In its application to the management of private holdings forestry has lagged far behind its record of progress on the National Forests. With a fast-diminishing timber supply and steadily rising lumber prices the vast bulk of our cutting is done destructively. This is a matter which seriously concerns the public welfare.

Ten years ago the Department of Agriculture offered, in pursuance of investigations in forestry, and in order to disseminate a knowledge of improved ways of handling forest lands, to cooperate with private owners through expert advice and assistance in planning and putting into practice forest management for their holdings. The investigations thus made possible were of the first importance. But for them the Government would have been altogether unprepared to undertake six years later the scientific management of the National

Forests. They were in fact the foundation and virtually the beginning of practical forestry in the United States.

This offer has never been withdrawn. The work which its fulfillment involved was the chief cause of the rapid growth of the Forest Service between 1898 and 1905. Since 1905, however, the necessity of providing first of all for the needs of the National Forests has compelled curtailment of expenditures for general investigations, since neither men nor money have been available to carry them on.

The following table shows the number of applications received each year since July 1, 1898, and the total areas for which examinations were asked and made. There is added also a statement of the expenditures of the Forest Service for all purposes other than National Forest work during the same period.

Year.	Number of applications.	Acreage for which assistance was asked.	Acreage for which examinations were made.	Expended for other than National Forest work.
1899	123	1,513,592	400,000	$28,520.00
1900	35	964,450	878,670	48,520.00
1901	38	288,555	788,890	88,520.00
1902	37	1,904,476	1,620,600	172,182.17
1903	94	947,047	421,172	262,566.42
1904	136	3,878,930	340,612	272,809.19
1905	167	1,447,272	505,383	340,953.32
1906	160	770,023	2,083,189	234,400.54
1907	91	283,176	808,638	262,175.89
1908	57	998,576	203,714	297,840.40

It would appear from the figures that there has been a decline since 1905 in the number of applications for assistance. This has not been the case, since the figures represent only the formal applications. There has been a steady increase in the number of informal applications, but many of these were not encouraged to fill out the necessary blanks, since neither men nor money were available to make the examination.

There is urgent need to enlarge this work. The time is ripe for a widespread taking up of forestry by private owners of timber land, large and small, if the Forest Service can be in a position to guide and assist a general movement through fulfillment of its offer. None of the National Forests is east of the Mississippi River, and nine-tenths of the expenditures of the Service are on behalf of the National Forests. It is a national duty to protect and put to best use this great resource which is directly under the charge of the Government; but it is no less a national duty to promote in the East the spread of methods through which this part of the country also can preserve its forests.

WORK OF THE YEAR.

The activities of the Service fall under the main heads of National Forest administration, Federal and State cooperation, and General investigations.

NATIONAL FOREST ADMINISTRATION.

The number of National Forests under administration at the beginning of the year was 169, and at its close 182. In both cases the only National Forest not under administration was the Luquillo, in Porto Rico. The administrative, executive, and protective force numbered 1,512 at the beginning of the year, and 1,961 at the end.

Certain lands within National Forests are covered by unperfected claims. Under the general land law such claims can be initiated only under the mining laws, or for land which is found by the Secretary of Agriculture to be chiefly valuable for agriculture, and which is recommended by him to the Secretary of the Interior for listing for settlement and entry. Claims initiated before the National Forests were created, mining claims, and claims for agricultural land listed as above may be perfected in exactly the same manner as claims for lands outside of the Forest. All questions of compliance with the land laws are by law within the jurisdiction of the Department of the Interior. Since the duties of the Forest officers require them to be familiar with the land embraced within National Forest claims, the Secretary of the Interior has requested this Department to make reports of such conditions, and Congress has authorized the Forest Service to assist the Department of the Interior by ascertaining and reporting the actual facts on the ground. Since few Forest rangers have a practical knowledge of mining, the Forest Service has called to its assistance geologists from the United States Geological Survey, and has employed mining engineers and practical miners to make reports upon mining claims. During the past year reports were made to the General Land Office on more than 6,000 claims for lands in National Forests. Of such reports 76 per cent were favorable. Action by the General Land Office, which resulted from reports made for several years previous, resulted in the cancellation of invalid claims to 50,000 acres of land bearing over 330,000,000 feet of merchantable timber. Every precaution is taken to avoid injustice to those holding claims. The claims which have been canceled by the Department of the Interior are those which were made for speculative purposes, and not for the permanent development of the lands. This work of examination is producing good results and is promoting the bona fide development of farms and mines. It increases the burdens which rest upon the National Forest force, but the expense to the Government occasioned by such examinations is repaid many times by the land and timber saved from speculative and fraudulent claims.

Examinations of lands under the act of June 11, 1906, led to the listing for settlement of about 240,000 acres of National Forest land.

The amount of National Forest timber sold during the year was slightly over 386,000,000 feet, or not much over one-third the amount sold the previous year. The falling off was directly due to the refusals to make large sales. Under such sales the actual cutting is allowed to extend over several years. The amount of timber cut and paid for during the year, however, more than doubled the cut of the previous year, with a total of not quite 393,000,000 feet. The receipts from timber sales were about $850,000, as against not quite $670,000 for the previous year. In addition there was cut under free use over 130,000,000 feet of timber, valued at about $170,000.

Reforesting of large areas of the National Forests is called for primarily in the interest of the water supply of the West, but also, though less pressingly, for the sake of an enlarged timber supply. Broadcast sowings were made during the year in 27 Forests, in 8 States, to test by experiment the extent to which reforestation may be hoped for through the use of this method. The National Forest nurseries in which are being grown stock for transplanting were enlarged and about 700,000 trees were planted. Over 2,000,000 trees will be ready for planting in 1909.

The beneficial results of regulated grazing, shown in a decided betterment of much of the National Forest range, made it possible to increase the allotment of stock on a number of the older Forests. At the same time investigations in range improvement through reseeding, new methods of handling stock, the eradication of poisonous plants, and the destruction of prairie dogs brought important progress toward still better future use of the Forests by stockmen. The development of watering places is another means that is being pursued to the same end, while the killing of predatory wild animals by Forest Service hunters saved the stockmen losses probably greater than the entire amount paid in grazing fees. This amount was over $960,000. Through the enforcement of quarantine regulations and the distribution of blackleg vaccine other losses from disease were prevented.

FEDERAL AND STATE COOPERATION.

At the request of the Secretary of War, supervision of the sale of mature and dead timber on the Fort Wingate Military Reservation, in New Mexico, was undertaken, and examinations were made of the timber on three eastern reservations for which forest management is contemplated. Through an agreement with the Secretary of the Interior, I have undertaken that the Forest Service shall assume charge of the management of forests on Indian reservations. Under this agreement the Forest Service has assumed charge of log-

ging and milling the timber on the Menominee Indian Reservation, in Wisconsin.

Cooperative State forest studies were carried on with Kentucky, New Hampshire, and Illinois, and advice was given on request concerning forest taxation and other matters of legislation in many States, including Alabama, where a comprehensive forest law was enacted.

GENERAL INVESTIGATIONS.

A careful study of forest, water, and land conditions in the Southern Appalachian and White Mountains, authorized by special appropriation of Congress, made clearer the industrial and economic importance of forest preservation in these regions, for the sake of timber supply, water and power supply, navigation, and the control of floods.

Through cooperation with private owners investigations in forest management and forest planting were continued. It was possible to make field examinations of only about one-fifth of the total acreage for which advice concerning forest management was sought. Every tract of land on which the advice of the Service is applied becomes a valuable experiment in practical forestry. The total area for which examinations have been made since cooperation was first offered is nearly 11,000,000 acres, and on more than three-fourths of this some form of forestry is now in actual practice.

The studies in wood preservation and in the strength and physical properties of different kinds of wood maintained the position of the Forest Service as leader toward more economical use of wood material. Special attention was given to working out practicable methods for treating farm timbers in small quantities. Studies in wood pulp making showed that a merchantable pulp can be made from 15 woods not commonly used. Along many other lines also data were gathered looking to better knowledge and control of our Forests and better use of their products. At the same time, the work of bringing to the attention of the public the knowledge gathered for the use of the public was vigorously prosecuted.

BUREAU OF CHEMISTRY.

The report of the Chemist records the progress made during the first year of the execution of the Food and Drugs Act. The manifold difficulties in the organization and inauguration of such a work are apparent even upon superficial consideration of the subject; and, when one considers the scientific problems involved, the necessity of training the majority of the increased force, whether scientists or inspectors, and the double duty of securing justice for the manufacturer and the consumer alike, it is apparent that it is the part of

wisdom to make haste slowly, particularly in regard to some decisions which are especially far-reaching in their effects. In putting the law into operation, every effort has been made to avoid working hardship upon any one. The decisions of the Board of Food and Drug Inspection as reached have been issued in a series of leaflets and have been widely distributed to manufacturers, dealers, and importers, that they might be aware of the attitude of the Department in regard to the points raised. At the same time much of the moral effect of the law depended upon a vigorous enforcement of its provisions, and such enforcement was plainly due the consumer for the protection of his health and his purse. It has been the endeavor of the Department to pursue a purely impartial and equitable course, giving due weight to all of these considerations.

INSPECTION UNDER THE FOOD AND DRUGS ACT.

A statistical statement of the samples taken and analyzed, seizures made, and prosecutions brought conveys practically no idea of the volume of work involved or the effect produced on the quality of food products. The number of branch laboratories has increased from 6, examining only imported products, to 21, analyzing both interstate and foreign samples. These laboratories are located at the following points, selected because of the control afforded interstate commerce: Boston, Buffalo, Chicago, Cincinnati, Denver, Detroit, Galveston, Honolulu, Kansas City, Mo., Nashville, New Orleans, New York, Omaha, Philadelphia, Pittsburg, Portland, Oreg., St. Louis, St. Paul, San Francisco, Savannah, and Seattle. The number of inspectors was increased during the year to 39 and approximately 13,400 samples have been collected and distributed among the branch laboratories and to the Division of Foods and the Division of Drugs of the Bureau of Chemistry. Inspectors are assigned to the branch laboratories and to such other points as afford an advantageous situation in regard to the interstate distribution of supplies. Of the samples analyzed and found to be adulterated, 814 were found to have been collected under such conditions that prosecution could be brought. Data in regard to such cases are checked first in the Division of Foods or the Division of Drugs of the Bureau of Chemistry at Washington and then are referred to the Board of Food and Drug Inspection for recommendation and reference to the Department of Justice for legal action.

In addition, the inspectors have collected data necessary to institute proceedings for the seizure of 86 shipments for confiscation by a process of libel for condemnation. The shipments include cider, honey, coffee, flour, canned fruit, sirup, molasses, wine, meal, beer, vinegar, stock feed, and canned vegetables. These seizures usually

represent large quantities of the products, as, for example, 135 barrels of cider, 40 cases of coffee, 2,240 sacks of flour, or 1,078 barrels of wine. In some cases the shipment was destroyed, for instance, 84 bags of coffee colored with lead chromate. In many other cases, where only misbranding is involved and this may be corrected by relabeling, the goods are returned to the owner upon payment of costs and the delivery of a bond not to dispose of the product contrary to the law. This feature of the law has not proved uniformly desirable, inasmuch as the manufacturer has in some cases failed to comply with the terms of the bond, necessitating an additional expenditure of labor and money for his reapprehension.

In considering the volume of work accomplished by the inspectors, the difficulties attending the collection of interstate samples must be considered, there being marked differences between the conditions under which the State inspectors work and those attending the work of the Federal inspector. In the latter case interstate transaction must be shown and the samples must be identified with the shipment received at that particular time, collection must be made in the original unbroken package, and it must be shown that the goods were received by the dealer subsequent to January 1, 1907. Further, the Federal inspector is not clothed with the police power conferred by the State, and no penalties are laid for hindering a Federal inspector in the performance of his duties. In this connection attention should be called to the fact that the manufacturers have shown a commendable spirit in their attitude toward the inspectors, and the steady growth in cooperation of manufacturers with the Government in the pure-food propaganda speaks well for the spirit in which the inspectors have done their work as well as for the progressiveness and honesty of the American manufacturer.

In addition to the collection of samples, the investigation of factories and work in cooperation with the chemists of the branch laboratories in conducting special investigations have played no small part in the activities of the inspecting force. The routine collection of samples of misbranded whiskies was supplemented by a special effort to locate large shipments of the product manufactured from neutral spirits and misbranded, under the decision of the Attorney-General, as straight whisky or blended whisky. Seizures have been made to the extent of 82 barrels and 6,702 cases, action in regard to the greater part of which is pending, and libel proceedings have been requested affecting 625 barrels and 31,359 cases of food and drug products.

Other subjects of special investigation by the inspecting force include distilled colored vinegar labeled as pure apple or cider vinegar; durum wheat flour bleached and marketed under a brand that was

misleading as to quality; watered or adulterated milk entering into interstate commerce at certain large centers; edible gelatin as associated in its manufacture with the gelatin used in the arts; and packages of cheese overmarked as to weight. As the inspectors in the present year will be called upon more and more to serve as witnesses in the courts, and the work of organization is now practically complete, it is apparent that the inspection force must be largely increased to insure a thorough enforcement of the law.

SPECIAL FOOD AND DRUG INVESTIGATIONS.

FLOUR.

A cooperative investigation in regard to the bleaching of flour and the use of durum wheat in flour milling was undertaken at the St. Paul, Chicago, and Washington laboratories, with the aid of the inspectors. In regard to the use of durum wheat, the leading millers were interviewed, the composition of 47 samples was determined, and a study was made of wheat mixtures affording information which had been much needed in regard to the branding of wheat flour. Seizures have been made and judgments obtained as to the misbranding of wheat flours which were mixed with flour from durum wheat and labeled hard spring wheat flour. The investigation in regard to bleaching flour was more extensive, as it called for a thorough study of the methods of grading and the results of baking tests, as well as chemical and physical examinations, before a conclusion could be reached. Over 1,000 determinations have been made in this study, and the investigation is nearing completion.

CANNED GOODS.

Special investigations, combined with factory inspection, have been made in regard to the canning of peas and the making of tomato ketchup. In the former case studies as to the grading of the product in connection with the question of proper branding have been made, and the effects of bleaching and the causes of spoilage have been studied. The ketchup experiments were made at a factory offered for the purpose, and included the manufacture of ketchup without preservatives, the causes of spoilage, the length of time elapsing both before and after opening when spoilage would take place, no preservative being present. Studies were also made of the antiseptic value of the spices, sugar, and vinegar employed. Methods of processing were also studied, and commercial brands were examined and compared with the experimental product. In connection with these studies it is of interest to note the increasing importance of the

microscope in the detection of adulteration, the presence of bacteria, fungi, and other signs of fermentation and decay being easily demonstrable by micro-chemical examination.

DRUG INVESTIGATIONS.

The investigation of imported drugs involved the examination of 568 samples, representing many phases of adulteration and misbranding. Illustrative of these may be mentioned dandelion root, adulterated with 20 to 40 per cent of sand and small pebbles; belladonna root, highly adulterated with poke root; callendula flowers, colored with saffron, imported for the purpose of adulterating saffron after its importation; and medical preparations accompanied by circulars containing false or misleading statements.

The examination of chemical reagents delivered to the Bureau of Chemistry is a very important item, underlying as it does the accuracy of the analytical work, and marked improvement has been effected in the quality of the chemicals delivered.

MISCELLANEOUS INVESTIGATIONS.

Numerous other investigations are in progress which are called forth by commercial conditions or are rendered necessary by the exigencies of the administrative work. The following are selected for comment as illustrative of the scope of the work:

Tanning materials.—The principles of tanning, the quality of the final product, and the source of supply of tanning materials are studied with a view to conserving the oak and hemlock forests from which these materials are largely drawn, as well as to improve the finished product. Other sources of tannin are investigated, and the desirability of establishing extracting plants in the vicinity of the raw supply, thus enabling the tanner to use other parts of the tree as well as the bark without an increased cost of transportation, has been suggested. Investigations of the Bureau have shown that there is sufficient tannin in other parts of the tree to warrant its use, but not its transportation in bulk.

Potable waters.—The extent to which mineral waters are being used rendered an examination of these products as they enter into interstate commerce advisable. Examinations accordingly were made of samples obtained at the sources of the waters and also as brought on the market. While it would be unfair to imply that the majority of these waters are sophisticated, nevertheless it has been found that a goodly number are contaminated in handling, as shown by the bacteriological findings, or are not true to label. The latter is especially apt to be the case in regard to mineral waters, the content of special

constituents supposed to have medicinal value being very small. As bottled waters are depended upon for special purity and for use in illness, it is plain that a high standard should be maintained and the product should be true to label. The object of the investigation under way is to assure the public that potable waters in interstate commerce may be depended upon in these particulars.

UNFERMENTED FRUIT JUICES.—Experiments in the manufacture of unfermented fruit juices without the use of preservatives have been conducted on an extensive scale. Tests of methods of manufacture and of storage in glass, in tin, and in wood, including shipping tests, have been made, and it has been positively proven that palatable beverages may be made and may be kept by sterilization by heat only. This work is of interest both to the manufacturer and to the farmer, who can make profitable use of fruit products not marketable and which in most cases go to waste.

DISTILLED LIQUORS.—The manufacture and handling of distilled spirits was studied in detail. This work included an inspection of the large distilleries of the country and the inauguration of experimental work at a Kentucky warehouse, where 60 barrels received from various distillers were set aside to determine the effects of various methods of treatment. Other phases of the investigation include careful studies of the methods of analysis and the determination of the composition of American whiskies, based on a large number of samples obtained from the principal distilleries of this country.

HONEYS.—A chemical and microscopical study of honeys of known origin and of commercial honeys had a direct bearing on the questions arising under the food law in regard to interstate samples. Careful studies of methods of analysis were made for the determination of adulterants, and the microscopical studies serve to identify the honeys as to their source by ascertaining from the pollen grains present the plants visited by the bees, the labels generally stating that the honey is from some particular floral source. Seizures of honey containing invert sugar and glucose have been made, and the data obtained in this investigation were needed for practical application.

LEMON EXTRACTS.—Claims made in regard to the large quantities of lemon extract imported, especially from Italy and Sicily, could not be substantiated otherwise than by a study of the conditions under which the product was made, as it was claimed that certain variations were due to local conditions. The lemon-oil industry in Sicily was accordingly investigated and the exhaustive line of samples is now being analyzed. The data thus afforded will solve the problem presented by this line of imported goods.

COMMERCIAL ALCOHOL.—The study of the manufacture of industrial alcohol from the wastes of the farm and of sugar-producing plants

has been inaugurated on a large scale. A plant manufacturing 75 gallons per day has been installed, and experimental runs, using corn, melons, small fruits, canning wastes, etc., will be made on a commercial scale. From these experiments it is expected that calculations can be made as to the comparative value of different wastes and materials for this purpose.

WORK IN COOPERATION WITH OTHER DEPARTMENTS.

While special investigations have for many years been conducted in cooperation with certain Departments, the practice of referring miscellaneous samples to the Bureau of Chemistry for analysis is constantly increasing, and there is hardly a Department for which some work is not done. The leading lines of cooperation are as follows:

A wide range of contract supplies, principally for the Bureau of Engraving and Printing, the Isthmian Canal Commission, and the War Department, are examined. The extent of the saving effected by the chemical control of articles delivered under contract and the raising of the quality of the supplies becomes more apparent with the progress of this work, and the analyses of paints and inks for the Bureau of Engraving and Printing have increased 50 per cent in the last year. The new work for the Isthmian Canal Commission promises to be especially effective, as without it the officials would be entirely at the mercy of the contractor were the goods delivered before inspection.

Two important lines of work conducted in cooperation with the Post-Office Department include paper investigations and assistance given in excluding from the mails certain fraudulent material, especially proprietary and patent medicines. Besides the tests of deliveries of paper for the Post-Office, similar tests are made for the Public Printer and the Bureau of Engraving and Printing. The actual testing of the samples is supplemented by research work looking to the improvement of the quality of paper and the methods of manufacture and to the conservation of the raw materials. Specifications are being prepared which, it is believed, will greatly reduce the cost of the Government paper supply without any injury to quality or the permanence of the records. During the year a laboratory was established at Dayton, Ohio, in order that papers for the Post-Office Department might be checked in the vicinity of the mill and the supplies be made to agree with the specifications before delivery, thus saving annoyance to the manufacturer and the buyer.

In regard to the drug work it is believed that the centers of propagation of fraudulent remedies and "cure-alls" have been broken up, and that in time this far-spreading evil will be practically destroyed so far as the mail service is concerned.

In collaboration with the Department of Justice investigations have been made in several localities, especially at Anaconda, Mont., and Ducktown, Tenn., in regard to the injury to vegetation and live stock by the waste products from smelters. The contamination of the air by arsenic and sulphur dioxide in the smoke emitted, which injure the trees and vegetation, and the danger from lead, zinc, and copper in the wastes thrown upon the land or into the streams have been made the subject of scientific inquiry. The results are used by the Department of Justice in bringing prosecutions for injury to public lands.

BUREAU OF SOILS.

To the Bureau of Soils is intrusted the study of the soil resources of the United States. There are three important steps in such a study. The first is to ascertain accurately by actual field investigation the extent, the location, and the boundaries of each and every distinct soil type in the country and to state its actual condition and efficiency as a factor in the annual production of new agricultural wealth. This work is being accomplished through the soil survey.

The second step is to ascertain those properties of soils, physical, chemical, and organic, which render each soil fitted to continue to produce profitable yields of crops, and to ascertain by what methods of cultivation, crop rotation, and fertilization the efficiency of each soil may be maintained and increased. This work is being done by the laboratories of soil physics, soil chemistry, and soil fertility.

The third step is to study all processes by which the actual soil substances are wasted or their properties essential to crop production are impaired, and to devise methods whereby such waste and impairment may be decreased or totally prevented. This work is being done through the investigations of the greatest source of soil wastage—soil erosion.

SOIL SURVEY.

The work of the soil survey was actively begun in 1899, when Congress first appropriated money for the purpose of making soil surveys. Since the inception of this work there have been surveyed 306 different areas in 44 different States and 2 Territories, exclusive of one area in Porto Rico. A soil survey is now in progress in one of the two remaining States, and one will be completed during the present fiscal year in the other State.

A total area of 157,078 square miles, or 100,529,920 acres, has been included in this work, and the Bureau of Soils maintains a field force of 62 men, working in different parties and completing detailed work in about 60 different areas, covering a total area of approximately 40,000 square miles each year.

In addition, reconnoissance surveys of 135,000 square miles annually are being conducted in the Great Plains and in the Appalachian Mountain and Plateau regions.

There are on file at the office of the Bureau of Soils requests for 478 additional soil surveys, covering nearly 500,000 square miles of territory.

A soil survey determines the exact character of the various soils, and their location and extent in each area is studied. It also ascertains their present use and capabilities by personal observation of the field force and the report of practical farmers owning and operating the soils and the farms investigated. It summarizes all of the present knowledge of these soils, whether obtained from the farmers who are cultivating them, from the chemical, physical, and fertility investigations of the Bureau's laboratories, or from the experimental and research work of the various State institutions concerned. It also enables all soil investigators and agricultural experimenters, as well as the farmers, to make direct comparisons between the soils of any one locality and of all others in the United States. It presents an unprejudiced statement of fact concerning each soil and its uses in each area, and, wherever possible, also forecasts and advises additional and more profitable occupation for each soil. It presents to the farmer a statement of what the full capabilities of his soils are and of the crops produced and methods of cultivation and soil management employed throughout the region in the successful handling of these soils. It gives to the investor and the home seeker those statements of fact concerning soil and agricultural conditions which are essential to insure safe investment and a satisfactory home. It calls attention to the undeveloped soils and their capabilities and the lines of their safe occupation and profitable development. It serves as a summary of the best that is known about soils and a forecast of the best that can be discovered. Such service is essential to the individual welfare of the citizen and to the well-balanced, systematic development of the National soil resources.

The importance of the soil survey as a factor in National development may be judged from the fact that the value of the annual products of the soil has now reached $8,000,000,000, and in the conservative estimate of the experts of the Bureau of Soils this stupendous amount might easily be doubled within the next twenty years through a complete comprehension of the full capabilities of soils now cultivated and the discovery of the proper uses for soils not now cultivated. Such an undertaking is worthy the careful consideration of all who desire the present achievements of American agriculture to be surpassed by those of the immediate future and by all who desire to provide a secure foundation for all the industrial activities of the Nation.

The necessities of that population for which the United States must provide under normal conditions of increase of population demand that all agencies leading to the increased efficiency of soils should be fostered.

WHAT THE SOIL SURVEY HAS ACCOMPLISHED.

The record of the practical accomplishments of the soil surveys can not be told in figures showing the area covered and the breadth of distribution of the different surveys. The interests served—the agricultural development obtained by these surveys—furnish a better basis for estimating the value and importance of the work.

While the European countries have been debating the possibility of such investigations in their own regions the United States has covered a territory greater than many of them possess. And yet the total area covered by detailed soil surveys in the United States is a little less than two-thirds that of the State of Texas. Compared with the accomplishments along these lines by foreign nations, the progress of soil-survey work in the United States has been rapid. Compared with the vast continental area yet to be covered and with the demands made upon the Bureau, it has been slow.

In the New England States the soil survey has aided in the development of the tobacco industry in the Connecticut Valley, in the reforestation of mountain and hill lands in New Hampshire, and in the study of the exceptionally valuable potato soils in northern Maine.

A complete soil survey has been made of the State of Rhode Island for the use of the farmers of the State and of the experiment station.

In New York State the soil survey is cooperating with the State college of agriculture, and the reports are used as a basis for agricultural and horticultural surveys by that organization. The chief problems are those of more intensive farming in the region of the so-called "abandoned farms" in southern New York, the extension of the grape industry through central New York, and the outlining of the lands peculiarly suited to the production of alfalfa in all parts of the State.

In Pennsylvania there is a strong demand for additional soil-survey work in connection with the work of the State college of agriculture in determining the crop adaptations and fertilizer requirements of the great variety of soils found within the State.

In Delaware, Maryland, and Virginia the soil survey is aiding in the development of the trucking industries along the Atlantic seaboard, of the dairying and live-stock industry in the Piedmont section, and of the fruit industry in the mountain lands. The further development of all these industries depends upon a thorough knowledge of the soils and of their ability to produce the different crops suited to these different sections.

In North Carolina the Bureau of Soils is cooperating with the State department of agriculture, and that institution is following the work of the soil survey by establishing branch experiment stations in such localities as have been covered by the soil surveys. The Bureau of Soils is aiding in the development of the swamp lands which have been and are to be drained in the eastern part of the State; in the development of the Piedmont section of the State, where the prevention of soil erosion is an important problem; and is studying the fruit lands of the mountain section, and determining the relative proportion of land suited to forestry and to agriculture.

In South Carolina the work of the Bureau of Soils is aiding in the extension of the trucking industry and the production of Sea-Island cotton in the coast section and in further diversification of farming based upon a thorough understanding of the soils of the entire State.

One of the most notable accomplishments of the Bureau of Soils is the development and extension of the tobacco industry in southern Georgia and northern Florida, in Alabama, and in east Texas, whereby the area planted to tobacco has been more than doubled since the inception of soil survey work in the region and the profits derived by the farmers have been more than quadrupled in the last six years.

In the Central States the study of the corn soils and the separation of these from the soils peculiarly adapted to wheat production is being conducted. In Michigan and Wisconsin a study has been made of the sugar-beet soils and of the possible extension of sugar-beet production. The work of investigating the agricultural possibilities of the soils of the cut-over pine lands in Michigan and Wisconsin has just been begun. It has been found that considerable areas of land well suited to agricultural occupation exist within these regions and that they need to be carefully distinguished from other soils which are practically worthless for the production of annual crops, but which in the northern parts of both of these States might well be reforested.

PROBLEMS IN THE USE OF SOILS.

The great problem of the northeastern States is so to utilize their soils that they may produce upon an intensive scale those crops which yield large returns per acre, which have a particular market value in the great seaboard cities, and which may be produced practically without competition from the more level central prairie States. The great variety of soils in the northeastern States and the fact that they have been farmed for two centuries practically to grass and grain crops makes it necessary to show the farmers of the section that these soils have other higher values than the production of the cereal crops

and hay. Any change which may be brought about by this knowledge will be slow and gradual, and it is necessary first to demonstrate the desirability of such changes and then their possibilities.

In the South Atlantic States the problems are similar, except that large areas of unoccupied land still exist, and that the problem of the drainage of a portion of these lands along the coast and the determination of their crop value is paramount. Farther inland, in the Piedmont section, the prevention of soil erosion is one of the chief problems.

In the Gulf States the development of special industries along the coast is showing uses for lands which have previously been considered of little or no agricultural importance, and lands once held at a nominal value for their timber stand now have a greater value as agricultural lands even after the timber has been removed. This is largely due to the fact that their agricultural uses have been shown by a number of well-located soil surveys.

The problems of the central prairie States have in general been well worked out by the farmers of those States, and, until economic conditions in the United States change, the chief value of the soil surveys in the different States will be to enable the farmers to compare directly the best methods to be employed in the handling of their different soils. The other important problem is to determine the character of the soils in the vicinities of the large cities, in order that a local market-garden supply of vegetables and fruits may be raised near to the point of consumption. The greatest problem of the Upper Lake region is to determine the extent of agricultural lands and their uses in the cut-over timber belt.

In the far West the opening of Indian Reservations and the extension of irrigation systems annually make available for agricultural purposes large tracts of land about which there is little or no information, so far as the nature of the soil and its peculiar fitness for various crops is concerned. The change from extensive grain farming to intensive methods of agriculture in the fertile valleys of California and Oregon is likewise making available large tracts of land that under the changed conditions will support a population many times as large as formerly. Expert knowledge of the soil and its power to produce fruit and truck crops is essential to make such worthy enterprises successful.

All new tracts of land of this character are widely advertised and the cautious home seeker avails himself of all information that will enable him to make a wise selection of soil. In such areas where soil surveys have been made the reports are eagerly sought for, but the increase in the number of new and favorable localities in the fast-developing Western States emphasizes the necessity of making these additional soil surveys if the Department is to furnish this information to the farmer.

In Oregon and Washington, where the removal of the original forest growth has progressed sufficiently far to permit the farmer to engage in agriculture, the soils have yielded well all those truck and fruit crops which are in great demand in the Alaska mining districts. Additional surveys are needed in these northwestern forested areas to help the people to a better understanding as to just what these soils will produce.

The Bureau has continued active cooperation with the Reclamation Service in surveying the soils of the various projects under construction. This is likewise essential to the complete success of these undertakings on the part of the Government to make homes for the people in what are at present arid wastes.

RECONNOISSANCE SURVEY OF THE GREAT PLAINS REGION.

A noteworthy achievement just accomplished is the completion of a reconnoissance survey of an area of approximately 40,000 square miles in western North Dakota, in the Great Plains region. This region includes that portion of the country west of the one hundredth meridian and east of outlying ranges of the Rockies, extending from the Canadian boundary on the north to the Rio Grande on the south, and contains several hundred thousand square miles.

The transformation of these plains into prosperous farming communities has progressed rapidly during the past few years, owing largely to fertile virgin soil, favorable rainfall conditions, and proper dry-farming methods. Detailed soil surveys in various parts of this extensive area have given the new settlers exact knowledge of the soils of certain restricted localities, and in order to protect the interests of the homesteader it seemed imperative to complete as soon as possible a general or reconnoissance survey of this entire region to determine just what soils can be expected to yield remunerative crops in dry seasons as well as in years blessed with abundant rainfall and what crops can be grown most profitably.

In the area completed in North Dakota large yields and the rapid extension of railroad facilities for shipping grain crops have given an impetus to settlement, and so at present all the public lands have been filed upon except the rough portions of the Bad Lands, where the cattle industry still predominates. With but few exceptions the new settlers are prosperous, since in the more level portion of the State the soils are generally fertile, and, with proper management to conserve moisture, produce good crops.

With the completion of this area in North Dakota and the advent of cold weather the reconnoissance field force will be transferred to south Texas, where an area of several thousand miles will be surveyed, the party returning to complete the survey of eastern Montana the following spring.

In my opinion this reconnoissance survey of the Great Plains should be vigorously prosecuted until complete knowledge of the soil conditions in the form of maps and reports for the entire region is available to all who wish to make homes in this section of the country.

LABORATORY INVESTIGATIONS.

The laboratories of the Bureau of Soils are maintained mainly for the support and aid of the field parties. During the past year they have accomplished a largely increased amount of detailed analytical work to this end, necessitated by the increasing activities in other branches of the Bureau's work. Besides this, however, the laboratories have continued their fundamental investigations on the relation of the soil to plant growth, some of the results of which it is proper to notice here.

FACTORS TO BE CONSIDERED.

It is now recognized that a farmer in handling his soil is in much the same position as the foreman of a factory, and to get the most out of his plant and raw material it is necessary to establish as perfect a control as possible of raw material, processes, and product. To obtain this control in the case of the soil, it is necessary to understand the fundamental relations between the plant, the soil, and the weather and similar conditions of environment, and the relation of one crop to another as affected by different types of soil, etc. In studying these problems it has come to be recognized that we must consider first three things: (1) The plant; (2) the soil moisture, which is the great food source of the plant; and (3) the mixture of solid mineral and organic compounds of the soil which determines the nature of the soil solution on which the plant feeds. These three things have this in common, that they are always more or less in motion. Not only the tops, but especially the roots of a living plant are constantly in motion, and if for any cause the motion stops the plant must die. The soil moisture is constantly in motion, for when the rain falls upon the earth a portion enters the soil, passing with comparative quickness through the larger pores and openings into the subsoil and lower depths, but with the return of fair weather a large part of this water slowly but steadily rises through the finer pores and on the surface of the soil grains to the surface of the field, bringing with it from the lower depths much dissolved material, which is thus made available to the plants in the surface layer. Finally, the solid grains are constantly moving among themselves. Every time a soil is wet or dried it changes volume, which means that the soil grains are constantly moving, as a soil in the field is always changing its moisture content. Every growing root causes some movement of the soil grains. Earth worms and burrowing insects play their several parts. Every breeze that blows removes some little soil from the surface of the field or else adds

some from elsewhere. Every shower moves to some extent the surface soil. The sum of these movements is within a few years astonishingly large, and there is a profound change as far as the individual particles of the soil are concerned in every field, subsoil becoming surface soil, surface soil removed or replaced by materials from divers places, etc.

These movements which lie at the basis of soil fertility and crop production are all more or less readily affected by the three practical methods of control which human ingenuity has devised—cultural methods, crop rotation, and fertilizers or soil amendments. These movements in turn determine the physical, chemical, and biological conditions in any soil and its suitability for the production of any given crop or rotation of crops. Broadly speaking, the investigations of the laboratories of the Bureau of Soils aim to elucidate and make clear, and if possible give quantitative expression to the interrelations between these fundamental and natural soil phenomena and the known methods of control, with a view to improving the latter, reducing them to a logical basis, and removing them from the condition of empiricism in which they have so long remained.

RELATION OF PHYSICAL PROPERTIES OF SOIL TO MOISTURE CONTENT.

The relation of the physical properties of the soil to the moisture content has been further studied. It has been shown that there is a critical moisture content where the water in the soil ceases to be entirely in the form of films over the surface of the soil grains and some of it is in the form of ordinary free water in the interstitial spaces. The free water can be easily removed, as, for instance, by mechanical means, while the film water is held most tenaciously by forces measuring thousands of pounds to the square inch. This critical moisture content corresponds to the condition familiar to practical farmers and gardeners and referred to as the "optimum water content," supposedly because plants could most readily obtain their needed water when the soil was in this condition. The researches of the Bureau have shown, however, that the true explanation is that this particular moisture content is that at which the soil can be put into the best possible physical condition; that it is different for different soils, but the same for all ordinary plants on any given soil. It is the moisture content at which plowing, harrowing, or other methods of cultivation will produce the best results and give the greatest porosity, aeration, and penetrability to plant roots. Laboratory methods for determining this critical moisture content, with precision, have been developed, and it is now a comparatively simple matter to determine this important datum for any given soil.

It has further been shown that the diffusion of heat into a soil (a most important factor in the germination and early growth of a

crop) takes place most readily when the moisture content is slightly greater than the optimum, but is greatly retarded by a content much above or below this point. This investigation has also brought out important information regarding certain special methods of cultivation, as the flooding of cranberry marshes, etc.

SOIL EROSION.

In connection with the work on soil erosion which the Bureau is carrying on, a laboratory method has been devised for studying and comparing the erosiveness of different soils, and it now appears, contrary to popular opinion, that the soils of our Southern States are not inherently different from northern soils in this regard, but that the greater amount and extent of soil erosion observed in the South is due mainly to the torrential character of the rains and other climatic conditions peculiar to that section, and to faulty methods of cultivation. Practical methods for preventing and remedying erosion are now well understood, and there is a very gratifying increase in their use, but the subject yet remains one of our great practical agricultural problems. In this connection the studies on flocculation and sedimentation have been continued, studies which are expected not only to yield important practical results in the control of erosion, but which have an even greater value for the maintenance of the "crumb structure" and looseness of the soil so earnestly desired by farmers.

While the great carrying power of water in effecting the translocation of soil material is obvious, the importance of the wind in this connection has not been so generally recognized. Important movements of soil material by water take place only occasionally, and then in restricted areas, as along river courses, etc., while the wind is acting practically all the time and throughout the entire extent of land surface. An important and careful investigation has been made by the laboratories this past year, which shows among other things that the aggregate translocation of soil material by wind is many hundreds, perhaps thousands, of times that produced by water, and through incomparably greater distances. The wind, in fact, is the great important agency in effecting that great complexity and heterogeneity of soil composition which recent investigations here and abroad have shown to characterize soils as distinguished from mere rock powders. This heterogeneity of soil composition is one of the most important fundamental generalizations of modern soil work, and has been confirmed by another investigation conducted in this laboratory during the past year, in which it was shown that the common rock-forming minerals are present in all soil particles, no matter whether they be coarse or fine. That is to say, that in every

grade of soil material from sands to clays there are the same minerals, carrying the important mineral plant foods, potassium, calcium, and phosphorus, although there is a tendency, as might be expected, for these substances to become segregated in the finest particles of the soil.

ABSORPTIVE POWER OF SOILS.

This segregation of mineral plant nutrients in the finer soil particles—the silt and clays and humus substances—is the more interesting, as it is these substances which show the greatest power of absorption. It has long been a matter of common knowledge that soils are good absorbers for bad odors, offensive products of decay, etc. But in the same way they have the power of removing inoffensive substances from the air or solution by condensing them in or upon their soil grains. This is a most important fact, as by it added fertilizer salts are conserved and prevented from being quickly washed out of the soil; and also the composition of the soil solution is automatically and naturally kept under control more or less effectively. A very thorough and careful investigation of this subject was continued during the past year, and the laws controlling absorption and the proper methods of handling soils to augment absorption have now been very thoroughly worked out.

COLOR IN SOILS.

An important property of soils is the color, not only because the color may directly influence the soil, as in the relatively greater power of absorption of heat by darker soils, but as indicative of differences in the character of the soil material or its past conditions, which differences are not themselves obvious. In other words, the color is "symptomatic" of some other property or condition. The differences between red and yellow soils have become almost a classical problem to geologists and soil investigators, and, aside from theoretical considerations, the matter is of practical agricultural importance, since, speaking generally, red soils are more productive than yellow ones. Systematic work has been conducted on this problem, and it now appears that the color differences may be due to one or more of several factors, such as thickness of coating, hydration of the iron oxide, etc. Incidentally valuable information has been obtained regarding the solubility of iron oxide in various mineral and organic acids and the nature of the so-called ferric salts. The solubility of iron oxide in the presence of various reagents is a question of fundamental importance in rock decomposition, soil formation, the transport of iron, and formation of iron hardpans. It is a matter of immediate practical importance in the cultivation of certain soils in Coastal Plains, for instance. Not only do the ordinary mineral and organic acids affect this solubility, but in the aggregate an

enormous influence is exerted by carbonic acid. This has led to an investigation of the absorption of carbon dioxide and solution of soil carbonates, which gives us for the first time precise and definite knowledge concerning these important soil components and throws light on such practical problems as the handling of hardpans, soil conglomerates, soil drainage, etc.

INDEPENDENT INVESTIGATIONS.

A number of independent investigations have been carried on, which, while of technical importance, need only be mentioned in this connection. Thus, the chemistry of the Bordeaux mixture has been worked out; a new form of Wheatstone bridge designed for determining the soluble salts in soils, soil moistures, soil temperature, etc.; and new methods for the estimation of the organic matter in soils and of nitrates have been devised.

HUMUS.

An important and perennial subject of soil investigation is the organic matter in the soil known as "humus." Investigations of the physical and chemical properties of this substance have been continued during the year. It is a complex mixture, differing markedly in properties in different soils. The separation of the different components forming it has long defied the efforts of the chemist, but quite recently the laboratories of the Bureau of Soils have devised methods by which most gratifying progress is being made in this direction. It is not too much to expect that before many years the indefinite and rather meaningless term "humus" will disappear and we will speak of the different compounds forming it and their specific properties. Of these there appear to be two classes. The first includes the organic compounds common to most or all soils. So far as we now know these appear to have but little chemical or physiological effect on plants, but are mainly important for their physical effects on the soil. The substances of the second class are found in an individual soil or a few soils as a result of special conditions. Frequently these appear to have a profound and direct effect on plant growth.

FERTILITY INVESTIGATIONS.

In the fertility investigations of the Bureau of Soils some very important problems have been attacked and some very noteworthy results obtained which can not fail to be of the greatest value to further research in these lines and thus become of the greatest practical importance to the farmer. The soil investigator encounters many soils which do not respond to fertilizers, or if they have responded in the past, no longer do so at the present time, or at least

require an entirely different system of fertilization from that necessary at the beginning. Fertilizers give in different seasons and in different years results which are not consistent but more or less erratic. The use of commercial fertilizers is constantly on the increase and conservative estimates place the expenditure at more than $100,000,000 annually. The use of fertilizers is an outgrowth of an idea formulated somewhat more than half a century ago that the growing plants removed more of one constituent than of others, thus impoverishing the soil of this particular constituent; and this must be replaced in order that the productivity of the soil might not be diminished. It was therefore proposed that chemical analysis of plant ash and of the soil would determine the needs of the soil. While chemical analysis has conferred many practical benefits on agriculture, it has effected comparatively little toward settling the great questions of fertility or sterility of our agricultural lands and of the action of fertilizers or soil amendments. The hopes that an analysis of the soil would confirm the practical experience of the farmer have not been realized, nor has the ratio of these various ingredients from the point of view of chemical analysis thrown more light on the question. Experience has shown that the action of fertilizers and soil amendments in general is not wholly explainable on the plant-food basis, and we must look to other factors for explanation of their full efficiency.

COMMERCIAL FERTILIZERS.

It is this problem that has engaged the Bureau's attention for a number of years, and the extended use of commercial fertilizers in the United States makes it imperative that a thorough understanding of the action of fertilizers be obtained, for perhaps as much as a third of the money spent for fertilizers is annually wasted and brings no adequate return, owing to this lack of understanding of the soil's requirements. One of the most interesting results of this work has been to show that fertilizers have properties of improving soil conditions in addition to the plant food which they supply, and that in some cases this action may be of even greater importance as far as practical results are concerned than the plant food added. The Bureau's exhaustive studies in this difficult field have shown that in some of the unproductive soils this unproductivity is not due to the lack of any of the mineral plant foods, but is distinctly due to the presence of harmful properties which prohibit the plant from performing its normal functions when growing in the soil. The presence of these bodies in such soils has engaged the Bureau's attention for some time, and with the methods at its disposal it has been able to show that they exist, and that the soils and the extracts from these soils possess toxic qualities.

ISOLATION OF TOXIC BODIES.

The most noteworthy advance in this work, and one which is of the greatest interest to practical agriculture, is that some of these bodies have now been actually isolated. They are not substances of mineral origin, but form a portion of the organic matter of the soil. It appears that in previous investigations of soils the organic matter has not been adequately considered, the investigators contenting themselves with determining the amount of organic matter present and the total nitrogen available in this organic matter. The researches of the Bureau therefore throw a great deal of light on the functions of organic matter in the soil. During the past year the Bureau has studied further this organic matter, with a view to determining its relation to the changes which are going on in every soil.

Isolation of some of these bodies of organic origin has been very difficult, inasmuch as there has been no past work to serve in any measure as a guide, but enough results have already been obtained to show this to be a most profitable and encouraging line of agricultural research, one which has a bearing on the questions of fertility and infertility of agricultural lands and the action of fertilizers and other soil-ameliorating agencies in causing the soil to yield profitable returns. The Bureau investigations have shown that the organic matter of the soil is exceedingly complex and very little understood, either from a chemical or physiological point of view, especially in regard to its direct influence on plant growth, either as a promoting or as a hindering agent. In the past it has been valued chiefly as a means of improving the physical condition of the soil and as a source of available nitrogen. The Bureau, however, has shown that this organic matter of the soil has a distinct bearing upon the question of crop growth, because of the presence of harmful organic constituents in some soils and beneficial ones in others, and that these are influenced in their action upon plant growth by the presence of fertilizers in soils.

ORIGIN OF ORGANIC MATTER IN SOILS.

The organic matter of soils originates from plant débris, fragments of roots, leaves, bark, stems, etc., which on the death of the plants are returned to the soil. In addition to this there is a strong indication of the presence of organic matter introduced into the soil by the living plants, either as direct excreta or thrown off by some of the outer cells of their roots so that there is a direct relationship between the living plant and the soil in this manner. This plant débris or plant excreta is then changed and altered by the processes of decay which may be induced by the action of soil bacteria, soil molds, etc., and also by chemical oxidation, by the oxygen of the

air or root oxidation performed by the living roots or the enzyme secreted by them. All of these factors are, then, at work in changing the plant débris or excreta to other forms, and according to the condition which prevails the process of decomposition of these materials is shown to be different; that is, the same plant débris, or the same plant excreta, through the action of these different agencies, produce an entirely different result, producing in one case a soil rich in the dark-colored bodies, which are usually called "humus bodies," and in other cases light-colored bodies, which are entirely different in chemical properties and in some cases also in the physiological effect on plant growth. All of these various factors, then, which enter into the changes which the organic matter of the soil must undergo are being studied, and it has been shown that fertilizer salts have a very marked influence upon these actions, stimulating the oxidation which is produced in the soil by oxidation, whether by roots, by soil bacteria, or by enzymes, or even by direct chemical oxidation by the air. The influence of the purely cultural methods such as tillage in producing the proper changes in the organic materials has also been studied, and it has been shown that any alterations which produce increased aeration of the soil also tends to produce destruction of bodies harmful to plant growth, changing them to compounds that are harmless or even beneficial to crops.

INFLUENCE OF GREEN AND STABLE MANURES.

Other investigations of the Bureau during the past year have been the study of the influence of green manures and stable manure on plants and on the soil compounds. These researches have shown that properly decomposed green manure contains compounds which are beneficial to plant growth, aiding the plant to overcome any toxic conditions which may be in the soil in which it is grown to such an extent that a permanent effect upon the fertility of the soil is thereby brought about. The stable manure has been differentiated into organic and inorganic materials in the laboratory, and it has been shown that the organic materials have even greater influence in producing the healthful growth of crops than the mineral ingredients, although these aid materially.

BIOCHEMICAL RELATIONSHIP OF ORGANIC MATTER.

Throughout these investigations there has been a departure from the accepted lines of study of the problems of soil fertility in that the organic matter and its biochemical relationship have been especially studied. The influence of plant upon plant and of plant upon soil has been studied, as well as soil upon plant, and these studies have shown that one plant is capable of affecting the growth of another plant,

and that one kind of crop when growing continuously upon the same soil will have an effect upon the soil which renders it unfit for remunerative production of that crop, though not necessarily affecting the production of another crop. These relationships have been carefully studied and in some cases it has been possible to isolate harmful organic bodies from such soils more harmful to the crop producing them than to other unrelated crops. By such results the influence of crop rotation upon soils becomes much more intelligible and also leads the way to a proper understanding and a realization of the best system of crop rotation to be employed.

INFLUENCE OF BACTERIA ON ORGANIC MATTER.

The influence of bacteria on soil organic matter is another subject which demands further study, as the results so far obtained have shown that this action may be either direct or indirect, direct action resulting in the production of beneficial, harmful, or inactive organic compounds so far as crops are concerned, depending upon the conditions and the kind of bacteria at work. Bacteria also have an indirect effect, producing such products as ammonia, nitrites, and nitrates, and these affect the organic compounds of the soils. Still other factors of a biochemical nature must be taken into consideration. Experiments indicate a very strong influence of molds in the production of some of the bodies already isolated from the soil.

The investigations of the Bureau in the past year have thrown much light upon the problems which are before every farmer and every agricultural investigator, and the results already obtained are very encouraging.

BUREAU OF ENTOMOLOGY.

The work of the Bureau of Entomology has increased in scope and efficacy during the year. Admirable progress has been made in investigations under way, and certain new topics have been taken up.

WORK ON THE GIPSY MOTH AND THE BROWN-TAIL MOTH.

The work of the Bureau against these two injurious insects in New England has consisted largely in clearing up the thoroughfares leading from the most seriously infested localities by destroying the underbrush, removing poor trees, and burning all débris for a strip of 100 feet on each side of the road. The forests in many places in Massachusetts are seriously infested, and the method just described renders them comparatively innocuous as centers of distribution, since the roads through these forests are so clean that the caterpillars can not drop upon passing conveyances and thus become distributed over large areas. Scouting has been continued in Connecticut, Maine,

New Hampshire, and Rhode Island, and every effort has been made to prevent incipient colonies from becoming dangerous centers. Extermination has been aimed at where possible, and prevention of spread where the colonies are larger. Work against the brown-tail moth has been carried on only along roadsides where work is being done against the gipsy moth. In Maine, Massachusetts, and New Hampshire there are State laws requiring property owners in cities and towns to care for this pest, and in those States occasional advice to property owners with regard to the removing of the winter webs is the main effort of the Government workers. One hundred and thirty miles of road in the State of Massachusetts has been cared for during the year in the way of cleaning up the border strips, both by banding trees and by spraying. The conditions in New Hampshire have been shown by scouting to be more serious than has hitherto been suspected, but in Connecticut, Maine, and Rhode Island extermination is still a possibility. The work has been admirably done, and commands the commendation of officials and citizens of the States in question.

IMPORTATIONS OF USEFUL INSECTS.

The main work in this direction has been a continuation of the large-scale efforts to introduce and acclimatize foreign parasites of the gipsy moth and the brown-tail moth in cooperation with the State of Massachusetts. Additional expert assistants have been stationed at the headquarters at Melrose Highlands, Mass., and a large amount of European parasite material has been brought over and in much better condition than in previous years. An expert has been sent to Japan who has organized an efficient service among the Japanese entomologists and has secured the sending to this country of many thousands of parasites belonging to several different species. At the parasite laboratory new methods have been devised, and it has been shown to be possible to breed both the European and Japanese parasites in large numbers in artificially heated rooms, and thus to liberate them in infested woodlands in much greater numbers than before. These discoveries reduce the expense of the experimental work and at the same time increase its efficiency. During the summer of 1908 more than 200,000 specimens of the most active foreign enemies of both gipsy moth and brown-tail moth have been imported and liberated under the most favorable conditions. In all 51 species of parasites and predatory enemies have been introduced, and all secondary parasites have been destroyed. Of the 59 species imported, there is sufficient evidence that 7 species have thoroughly established themselves. The probabilities are that many more have succeeded, but thus far it has been difficult to determine this point. There has been during the past year a tremendous destruction of the larvæ of both

brown-tail moth and gipsy moth from bacterial and fungous diseases, and these diseases have in many localities killed off the parasites as well. The outlook for ultimate success is more favorable at the present time than at any period during the progress of the work. There seems no doubt whatever that eventually these imported parasites will multiply to such an extent as to render the gipsy moth and the brown-tail moth no more harmful than many of our native leaf-destroying caterpillars, but the experts of the Bureau of Entomology can not fix the date at which this desirable condition will be brought about.

A successful attempt was made to import from Europe a very effective parasite of the eggs of the imported elm leaf-bettle, an insect which has destroyed thousands of elm trees in the streets and parks of the northeastern cities of the United States, and has, by removing the leaves in July and August, injured the usefulness of many thousands more. This egg parasite has been successfully established in Massachusetts, New Jersey, and New York, and also in the District of Columbia, and it is probable that the effects of its beneficial work will be seen in the course of two or three years.

Another important effort in this line has been the sending of American bumblebees to the Philippine Islands to fertilize clover that may be grown in the Philippines, and still another effort has been the importation of the European enemies of the codling moth.

MEXICAN COTTON BOLL WEEVIL.

The work against this important pest has shown a number of promising features during the year. It has been found that native parasites are becoming much more effective in controlling the weevil. During the season the average parasitism has been shown to have doubled in Texas and trebled in Louisiana. Work has been carried on in the introducing of parasites from one region to another, with the result that in several cases the effectiveness of parasites has been greatly increased by the introduction of material from other regions. Studies of a native ant which is increasing in efficiency as a weevil enemy have resulted in the discovery of an especial method of attracting these ants to substances in which they will build their nests and in which they may be transported in enormous numbers into regions where they are not abundant.

An important apparatus for the control of the weevil has been invented and a patent granted thereon. At the instance of the Department of Agriculture this patent has been dedicated to the use of the public. The invention consists of series of chains attached to a light frame in such a way that when dragged between the rows the fallen cotton squares infested with weevils are removed from the shade of the plants and brought into a narrow pathway between the

rows, where they are exposed to the direct rays of the sun. This destroys and very greatly increases the mortality of the weevils in fallen squares. The same machine has a very useful cultural effect—it fills up the cracks in the soil and establishes a perfect dust mulch.

Experimentation on a large scale has shown that planting cotton by the check-row system instead of in drills, as ordinarily done, increases the yield of cotton per acre and possibly reduces the cost of production on account of the elimination of much hand labor. Further than this it aids materially in the fight against the weevil.

Very extensive work has been done on the study of the hibernation of the weevil, with a view to its possible control during the winter. This work indicates a much more abundant hibernation of the weevil in the Mississippi Valley, but at the same time indicates measures of control which are receiving further experimental investigation at the time of this writing.

It has been shown in the Mississippi Valley that the basic method of destruction of the weevil by the fall destruction of the cotton plants becomes even more important than it was in Texas. The large-scale demonstrations of the importance of this operation carried on by the Bureau of Entomology have been widely advertised in the Mississippi Valley, with the result that during the present autumn great interest was shown by the Louisiana planters, and in one parish more than 40 per cent of the planters undertook the fall destruction of plants, which gives great promise for the success of their crops the coming year.

INSECTS INJURIOUS TO FORESTS.

Extensive field investigations have been carried on in the National Forests of northern and central Utah, northeastern Oregon, southern Arizona, southern New Mexico, and throughout Colorado to determine additional facts regarding the distribution of the principal insect enemies of the Rocky Mountain forests. Field investigations have also been conducted in the forests of private owners, and on subjects relating to the interests of manufacturers, dealers, and consumers in eastern and northern California, Colorado, Michigan, West Virginia, Pennsylvania, Maryland, New York, and northern New England to determine additional facts on which to base practical advice to private interests in forests, farmers' wood lots, and manufactured, stored, and utilized forest products. Much success has been gained in the way of securing the adoption of measures recommended by the Bureau of Entomology by the owners and managers of extensive private forest interests. The inauguration and application of insect-control policies in the National Forests has received much attention.

It was determined by a thorough inspection during the last year that the efforts of private owners and forest officials during 1905–6 to control the alarming outbreaks of the Black Hills beetle in 1904–5 in the vicinity of Palmer Lake and Colorado Springs and the adjoining Pikes Peak National Forests, under the advice of the Bureau of Entomology, were a complete success. It was also demonstrated that, in the same way, the efforts of the owners of an extensive private estate in Colorado to control the depredations of the same insect were equally successful. The first of these was accomplished by the cutting and barking of 1,000 trees, the products of which paid a large share of the cost and resulted in the protection of timber valued at more than a million dollars. The second was accomplished by the cutting and barking of less than 500 trees, resulting in the protection of timber of perhaps even greater value than in the first example. The real value, however, of these two examples of successful control is far greater than that represented by the money value of the timber protected, since they demonstrate, first, that the most destructive enemy of the pine forests of the central Rocky Mountain region can be controlled at a comparatively slight cost, or even at no expense, whenever the timber can be utilized, and, second, the absolute necessity of expert advice as a guide toward doing the right thing at the right time and at the least expense.

INSECTS DAMAGING DECIDUOUS FRUIT TREES.

PEAR THRIPS.

An investigation of the pear thrips was begun in the fiscal year, and a field station for this purpose was located near San Jose, Cal. Careful life-history studies were made, and special attention was given to experiments in the field with methods of control. Various sprays were tried, and two of them give promise of efficacy—namely, tobacco extract and distillate emulsion. Careful tests have been made with the various methods of destroying the insect in the soil, but no definite results have been reached. The importance of this problem to the fruit growers of California and other Pacific States, as well, possibly, as to the fruit growers of the East, should the insect once be introduced into the eastern orchards, is very great. Many hundreds of thousands of dollars' worth of damage has already been done in the infested region of California, and it is the purpose of the Department to continue these investigations and experiments as vigorously as possible.

CRANBERRY INSECTS.

Beginning with the spring of 1908, an investigation of the cranberry insects in the Wisconsin bogs was undertaken in cooperation with the Agricultural Experiment Station of the University of Wis-

consin. Experimental stations have been established, and investigations indicate that, while the remedies to be used in the western bogs must be different from those in use in New Jersey and Massachusetts, the injurious insects may be controlled.

OTHER INSECTS.

Comprehensive investigations of the peach-tree borer and the plum curculio have been carried on at various points and demonstration field work against the codling moth has been under way at various points. Investigations and experimental demonstrations against the grape rootworm in the Erie grape belt have been practically completed, to the satisfaction of the vineyardists and to their great advantage. Studies have been made in connection with the serious outbreak of two species of bark beetles in the peach orchards of Ohio and of the grapevine Phylloxera in California. Further than this, an interesting and important investigation has been carried on relative to insects affecting drying and dried fruits in California, to determine the effect that sulphuring may have in affording protection against insect infestation.

FIELD CROP INSECTS.

THE SO-CALLED "GREEN BUG."

The great damage done by this insect in 1907 was the occasion for the beginning of a very extensive investigation to ascertain its life history and possible remedies. During 1908, however, no comparable outbreak occurred. By the end of June, over its entire range, from Texas to the Canadian border, the insect was present in limited numbers and apparently awaiting only favorable weather conditions to become again destructive. These conditions did not recur, and there was therefore no opportunity for large-scale remedial experimentation. A careful study of the insect over the greater part of its range has been made, with the result that facts have been obtained which will prove of practical value another season.

HESSIAN FLY INVESTIGATIONS.

Extensive wheat-sowing experiments have been carried on again in many States within the wheat belt. Valuable information has been gained, and the advice of the Department experts has resulted in the avoidance of much damage in several different localities. Further experiments in the transfer of parasites from one portion of the wheat belt to another have resulted in the complete saving of threatened crops, but a just estimate of the value of these experiments can not be formed until another season.

OTHER WORK.

Investigations of jointworms have been continued, and a serious outbreak of one of them in the State of Washington has shown that it is capable of doing great damage on the Pacific coast. Variations in life history on the Pacific coast indicate the desirability of further study upon which to base new remedies. Several other insects injurious to grains and grasses have been studied with profit.

INSECTS INJURIOUS TO VEGETABLE CROPS.

During the year additional work has been done on the insects affecting truck crops in Texas, Florida, and southern Virginia. The opportunities offered by this localized work in the way of experiments on a large scale in the field have shown that nearly all of these insects can be economically controlled. Insects affecting the sugar-beet industry in the West have been studied in cooperation with the State Agricultural Experiment Station of Utah, and an agent has been located in California to continue these investigations.

INVESTIGATION OF HYDROCYANIC-ACID GAS FUMIGATION IN CALIFORNIA.

This investigation was begun with the fiscal year. A thorough study was made of the existing methods, and this was followed by the institution of large-scale experiments, covering as rapidly as practicable the different features of the problem, in order to discover the best formulæ and mechanical methods and the particular dosage for the different insects involved and for trees at different conditions as to the effects on blooming or the maturity of the fruit. Many interesting problems have been evolved in this investigation, and the results already achieved have been of great value not only to the citrus-fruit growers of California but to all fruit growers who may in the future have occasion to use this process. The exact dosages under different conditions for the purple scale in California have been determined, and a study of the exact nature of the combination of the chemicals used in producing the gas, as well as the proper proportion and method of combination, has been carried on. It is the opinion of the commissioner of horticulture of California and of prominent fruit growers in southern California that the results achieved in the first few months of this investigation have already proved that ultimately many thousands of dollars will be saved to the industry.

INSECTS INJURIOUS TO STORED PRODUCTS.

An important investigation was begun during the fiscal year concerning the insects injurious to stored cereals in the mills of the South, at the request of many milling companies in Kansas, Oklahoma, Mis-

souri, and Texas, and on behalf of the steamship owners and operators of Galveston, Tex., and New Orleans, La. One of the special subjects has been the flour beetles which injure prepared cereals, especially such as are manufactured in Kansas and Missouri and shipped through New Orleans for European ports. The underwriters who insure against this damage claim that flour shipped southward in the warmer months through the warm climate of the Gulf ports is much more liable to damage by these insects, and report that many thousands of sacks of flour shipped by that route to various European ports within the last year were seriously damaged. In the course of this investigation it has been and will continue to be the especial aim to discover the main points of original infestation—whether in the mills, on the railways, on the steamship docks, or on the steamers; and these points once determined, remedial experimental measures will be instituted.

WHITE FLY INVESTIGATIONS.

The investigation of the white fly in Florida has been continued, on an enlarged scale, under increased appropriations provided by Congress. The important work has been carried on at headquarters, at Orlando, Fla. The principal lines to which the investigation has been devoted during the year were, first, the control of the pest by fungous parasites of the white fly, and, second, control by fumigation. Many important and interesting facts have been determined concerning the fungous parasites, and the fumigation experiments have indicated a favorable outlook for the complete success of the process. An improved tent and a new form of dosage table have been devised, and the process has been simplified so that an orange grower, by following simple instructions, can fumigate his trees with the same degree of accuracy as the most experienced expert. Practical demonstrations have been carried on in St. John, Orange, Hillsboro, Manatee, and Lee counties, and great interest has been manifested by the citrus growers throughout the State.

INSECTS AFFECTING TOBACCO IN THE DARK-TOBACCO DISTRICTS.

The loss from insects in the important tobacco area in Kentucky and Tennessee known as the "dark-tobacco region" during the spring and summer of 1907 is said to have amounted to $2,000,000. Headquarters were established early in the summer of 1908 at Clarksville, Tenn., and experimental work was immediately instituted. The habits of the insects in question are already fairly well understood, and the investigation has been largely in the way of determining the most effective insecticides and the best method of application. It has been ascertained that arsenate of lead is more effective than the preparations heretofore used, and can be applied more

economically. Much attention has been paid to control by cultural means, and excellent results are promised. No definite idea of the economic results of this experimental work can be gained, however, until another season.

INSECTS WHICH CARRY DISEASE TO MAN AND DOMESTIC ANIMALS.

WORK ON THE HOUSE FLY.

Presumably owing in part to the very general spread of information contained in circulars issued by the Bureau of Entomology, the country has been aroused during the last fiscal year as never before to the danger of permitting house flies to breed unchecked and to carry filth and disease through communities. Many boards of health have taken up the matter and much work has been done to emphasize the importance of this insect as a disease bearer. During the year an especial effort has been made to learn exact facts relating to the seasonal prevalence of the house fly, with the idea of comparing, at the close of the season, the increase and decrease of the house fly with the increase and decrease of typhoid fever, in the hope of emphasizing the part played by the house fly in the carriage of typhoid. This work has been carried on in the city of Washington, and the results will be announced upon the completion of the computations.

WORK ON THE LIFE HISTORY OF THE TEXAS CATTLE TICK.

Three investigators have been at work during the fiscal year upon the facts relating to the life history of the cattle tick. As a result of this study it has become possible to lay down an important law regarding time and conditions when cattle may be allowed to run in pastures without becoming infested. This discovery is based upon the fact that the tick eggs do not hatch in the spring until a certain amount of temperature is accumulated. One of the great difficulties in the control of the tick is that many ranchers are overstocked and can not leave part of their holdings of cattle in certain fields for the time requisite to starve out the ticks. This difficulty is minimized as a result of the discovery above mentioned, since it has shown the latest date on which it will be safe for cattle to remain in pastures from which the ticks are to be eradicated or reduced in numbers. During the year internal parasites of two genera of ticks have been found; and experiments are under way in an attempt to cause these parasites to attack the cattle tick.

Studies of other species of ticks have been carried on, since it is not unlikely that they will be found to transmit diseases of various animals. This has been recently shown by the demonstrations of the agency of the tick in the transmission of so-called "Rocky Mountain spotted fever" of human beings in this country. A practical demon-

stration was made on a large ranch in southern Texas of the application of a method of control resulting from life-history investigations. The results of this experiment were so conspicuous that the owner of the ranch thought that the pest had been completely exterminated. He was wrong in that opinion, but the experiment amounted almost to eradication and indicates what may be done by an individual cattle owner on a large ranch far south of the quarantine line drawn by the Department.

BEE CULTURE.

The work on bee culture has been enlarged, and its operations have been unusually productive. The work on bee diseases has been continued through the year, and it has been shown that the annual loss from these diseases, conservatively estimated at $2,000,000, may be considerably reduced by the application of better methods of manipulation. Testing of different races of bees has been carried on near Washington, and a study of the production and care of extracted honey, a study of the present status of bee keeping, experiments on mating queens in confinement, and other work looking toward the bettering of apiculture has been under way.

OTHER INVESTIGATIONS.

Much experimental work upon insecticides has been carried on, both under the general headings indicated above and in other ways. As usual, many suggested remedial mixtures have been referred to the Bureau of Entomology for investigation. A large amount of inspection work has been carried on. All of the seeds, bulbs, roots, bud wood, and grafts introduced by the Department from many foreign regions have been minutely inspected to prevent the introduction and establishment of noxious insects. Careful studies of scale insects and other insect pests of a miscellaneous character have been under way. Additional observations have been made upon insects injurious to shade trees, those injurious to flower gardens and greenhouses, and those injurious to the pecan.

BUREAU OF BIOLOGICAL SURVEY.

The several lines of investigation under way in the Bureau of Biological Survey at the time of presentation of my last report have been continued and new ones have been undertaken.

The material prosperity of the State and Nation depends upon agriculture, and whatever increases the certainty of agricultural operations in any way, especially by destroying the enemies of crops, directly concerns the farmer. It is from this point of view that the economic relations of our native birds and mammals are important.

The study of the habits of birds and mammals, especially of the species that prey on insects and feed on grains and fruits, is one of the chief duties of the Biological Survey. The results of this work are set forth in circulars and bulletins and widely distributed for the information of farmers and others, in order that they may know friends from foes, and so take measures to befriend the one class and suppress the other. Important as are such measures now, they must become increasingly important as time goes on and the acreage devoted to the needs of our expanding population becomes larger.

RELATION OF MAMMALS TO AGRICULTURE.

In their relations to agriculture mammals differ considerably from birds. Few birds are so harmful that their wholesale destruction is called for, since by devouring destructive insects most of them render a full equivalent for any mischief they may commit. Such is by no means true of mammals. A few are very beneficial, and the usefulness of such servants of man as bats, skunks, weasels, badgers, foxes, and moles should be known and appreciated, that their lives may be spared and they be allowed to continue their good work. Unfortunately, a much greater number of our mammals are everywhere injurious, and are the more dangerous because where they do not exist in great numbers their destructive habits often escape particular notice.

WOLVES AND COYOTES.

As the result of much experimental field work, the destruction of wolves and coyotes by locating the breeding dens and killing the young and by approved methods of poisoning and trapping have been earnestly advocated as the most practicable means of checking the increase of these formidable carnivores. Circulars describing these methods have been widely distributed to stockmen and others throughout the wolf country, with the result that during the past year more wolves and coyotes were destroyed than ever before, the total number of wolves known to have been killed being over 1,800 and the number of coyotes about 24,000. The saving of stock by this means is estimated at not less than $2,000,000.

It is earnestly pointed out that the safety of stock over the great cattle and sheep ranges of the West depends upon the persistence with which repressive methods are followed up. So long as wild land exists in vast tracts, so long will wolves find safe harborage and breeding grounds therein. By persistent effort, however, and at comparatively small cost, the number can be so reduced as to limit the damage done by them to a minimum.

FIELD MICE.

Although losses by field mice have proved a steady drain on the resources of American farmers and nurserymen, yet only occasionally and over limited areas has the damage been so great as to attract special attention. The extent of the destruction of crops by mice in the United States has never even approached that in Europe, where they have overrun whole provinces, leaving ruin in their wake. During the past year, however, a native species infested the alfalfa fields in Humboldt Valley, Nevada, in such multitudes as to destroy nearly the whole crop. Out of the 20,000 acres of alfalfa in the valley, 15,000 acres were a total loss, so that the fields had to be replowed and reseeded. During the past year the Biological Survey sent two assistants to Nevada for the purpose of conducting experiments and demonstrating to the ranchmen the best methods of destroying the animals. As the result of trials with various poisons, it was found that sulphate of strychnine on chopped green alfalfa, or when that is not procurable, on alfalfa hay, is a most effective poison. Even on ranches where the number of field mice reached the astonishing total of 12,000 to the acre, relief was obtainable by careful and systematic poisoning at the cost of only 70 cents per acre. By means of the combined efforts of the farmers of the valley, using methods devised by the Survey, the number of mice was finally so greatly reduced that the hawks and owls, gulls, herons, ravens, skunks, badgers, weasels, foxes, and coyotes, which had assembled early in the outbreak and killed at least 45,000 mice a day, were able to take care of the remainder and prevent them from doing serious damage, thus furnishing an important object lesson as to the usefulness of these destroyers of rodents when permitted to do the work they are fitted by nature to perform. A bulletin covering the subject in detail has been prepared and will soon be published and distributed throughout the alfalfa districts of the United States. Alfalfa farmers are earnestly urged to cooperate in applying repressive measures before the field mice have multiplied and assumed the proportions of a plague, since if active steps are taken in time their reduction is a comparatively short and inexpensive process. The matter assumes more than local importance in view of the magnitude of the irrigation projects now under way in the arid parts of the West, all of which are inhabited by field mice that only await a favorable opportunity to increase and become a pest.

HOUSE RATS.

The rat continues to cause great losses throughout the United States. During the past year an attempt was made to ascertain the approximate damage done to property by this rodent in the cities of

Washington and Baltimore. Many business men were interviewed, including dealers in various kinds of merchandise, feeders of horses, managers of hotels and restaurants, and manufacturers. The inquiries included all sections of the two cities and both small and large dealers. Data were obtained from some 600 firms and individuals, from which it was estimated that the annual loss from rats in Washington is about $400,000; in Baltimore, upward of $700,000. Assuming, as is probable, that similar conditions obtain in all our cities of over 100,000 inhabitants, the damage by rats in these centers of population entails a direct loss of $20,000,000 annually. This enormous sum gives an idea of the still greater total loss inflicted by this rodent throughout the length and breadth of the land.

The rat continues also to excite grave apprehension because of its agency in distributing the dreaded plague and other diseases. Boards of health and the Marine-Hospital Service in several of our maritime cities have been prosecuting active war against the rodents, and large sums have been expended in efforts to effect their extirpation. No one method has proved adequate, and only by concerted, systematic, and persistent efforts is it possible to reduce and keep down their numbers. The rat-proof construction of buildings, the constant use of traps, and the use of poisons wherever possible will go far toward assuring public safety. Experiments with various poisons and mechanical means of destruction have been made during the year, and a report on the subject with recommendations will soon be issued.

Several bacterial cultures for the extermination of rats and mice are on the market, and numerous experiments have been undertaken with a view to fully testing the claims made for them, especially the degree of communicability. When the culture is fresh and the vitality of the organism is unimpaired a large percentage of the rats eating infected bait sicken and die. Thus far, however, our experiments have not proved that the disease produced by the cultures is contagious. On the contrary, it appears to be limited solely to the individual rodents eating the bait. Hence the cultures appear to possess little or no advantage over mineral or other poisons, the cost of which is much less and the certainty of operation much greater.

GOPHERS.

One of the most destructive of the smaller rodents is the pouched gopher, the various species of which spread from the Mississippi Valley to the Pacific. The animal lives an underground life, feeding mainly on the roots of plants and destroying great quantities of grain and garden stuff. It makes its presence known by throwing up mounds of earth, which cover up grass and other valuable crops. Recently in the Far West the gopher has proved a serious obstacle

to the maintenance of dams and embankments of irrigation works by burrowing in them and causing expensive breaks. No animal, however, is more easily controlled by means of traps and poisons. At the request of the Reclamation Service the Biological Survey sent a trained assistant to the Truckee-Carson irrigation project to demonstrate approved methods of trapping, with the result that the animals were practically exterminated along the line of the ditches and are now being controlled with very little trouble and expense.

THE RABBIT PEST.

As in previous years, many complaints of damages by rabbits to orchard trees and to various crops have been received. In a previous report the well-known lime and sulphur wash in general use as a remedy against the San José scale was recommended as a protection against rabbits. A number of orchardists have been requested to give this simple and inexpensive remedy a fair trial. It is being experimented with in different sections, and highly satisfactory reports as to its efficiency have been received; hence its use on a larger scale will be urged. If, as has proved to be the case in several instances, a single application of this inexpensive wash will protect orchard trees against the attacks of rodents for a whole winter, the fact can not be too widely advertised.

GROUND SQUIRRELS.

In the great region west of the Mississippi River ground squirrels are abundant, and in States where grain is extensively cultivated they are exceedingly destructive and annually cause the loss of many thousands of dollars. In California it has lately been discovered that their presence in a community threatens a danger far greater than any pecuniary loss, however large. Recent investigations conducted by the United States Marine-Hospital Service prove that at least one species of ground squirrel is susceptible of plague, and carries the germ of this dread disease, which, as in the case of rats, is communicated to human beings through the agency of fleas. Hence, in regions infested by this particular species of ground squirrel, a crusade against rats alone as the source of plague is not sufficient, but must be supplemented by vigorous measures against ground squirrels. The Beechy ground squirrel, the only species thus far found to be plague-infested, inhabits practically the whole of the agricultural and fruit lands of California from San Francisco Bay to San Diego, and is most abundant in the foothills and coast ranges. East of the Sacramento River it pushes northward as far as Honey Lake. In some localities there are thousands of these animals, and the openings to their underground burrows are only a few

feet apart. Were they confined to cultivated lands, their extermination over wide districts would be comparatively easy, since the requisite cooperation of individual landowners might be had. Almost everywhere, however, cultivated tracts, whether large or small, are bordered by wild land, especially in the foothills, which serve as nurseries from which farming lands are soon repopulated. To attempt the extermination of this animal over the whole extent of its range would be a gigantic undertaking, probably impossible of achievement, but its numbers may be very greatly reduced and its increase prevented. Experiments with a view to discovering sure and economical means of destroying these animals have already been made by the Survey and will be continued. It is important to use poisons which will, so far as possible, kill the squirrels in their burrows, so that the fleas with which they are infested may not easily reach other animals or human beings.

A bulletin on the subject, containing directions for destroying the animals and accompanied by a map showing definitely the area infested by the Beechy ground squirrel, is in course of preparation and will be widely distributed among farmers and others, especially in the coast districts, where the danger of the infection of squirrels by plague-stricken rats is greatest.

DEER FARMING.

Since earliest times the several members of the deer family—elk, moose, caribou, white-tail and black-tail deer, and others—have been greatly prized. Eagerly pursued for sport, they are highly esteemed for food. Relentless hunting and the rapid encroachment of civilization on the natural breeding grounds of these animals have greatly reduced their numbers, and in certain sections have exterminated them. In most parts of the country venison has ceased to be a common article of food and has become a high-priced luxury. The rearing in confinement of certain members of the family, like the elk and Virginia deer, appears to present scarcely greater obstacles than cattle raising. For the purpose of raising deer for the market their domestication, even their semidomestication, though feasible enough, is not necessary; and one of the greatest advantages of the business is that tracts of unproductive land, when fenced, may be utilized for the purpose, the animals remaining almost in their natural state. It is claimed that there are 250,000,000 acres of land in the United States unfit for general agriculture or for the pasturage of horses, cattle, and sheep, upon which the raising of Angora goats would be profitable. It is thought that a large part of this vast tract, with equal or greater advantage, could be devoted to the growing of venison. The greatest obstacles at present in the way of the successful prosecution

of the business of deer farming are State game laws. These, originally framed to protect wild game, require modification so as to permit the sale of live deer for propagating purposes and of venison for food under such regulations of transportation and marking as to fully protect wild game. Here and there individuals have already succeeded in raising both elk and deer on a considerable scale. When once the objects and methods of the business are understood, and game laws are changed to meet the necessary requirements, it is believed that the rearing of venison may be made a commercial success. A Farmers' Bulletin on deer farming has been issued, detailing the results of past experiments, setting forth future possibilities, and explaining the best methods of procedure.

FOX FARMING.

Sooner or later the supply of wild animals which furnish food and raiment for man must be exhausted, because the needs of an expanding population continually increase the demand, and because the natural range of wild animals is constantly being encroached upon by civilization. This statement applies particularly to fur bearers, though perhaps with less force to foxes than to some other animals. While, however, the common red fox is remarkably successful in maintaining existence, even in well-settled districts, the more highly prized varieties, known as silver and black foxes, have become very rare and command a correspondingly high price. As the cost of the better furs places them out of reach of people of moderate means inferior furs are substituted, with the result that the supply even of these is being rapidly reduced and the price correspondingly increased. Under such circumstances the time seems ripe for attempting to rear fur bearers on a commercial scale. Fox raising has already been undertaken by a number of persons with more or less success, according to the location, amount of capital invested, and experience. As the result of recent investigations in the field, supplemented by correspondence, much information on the subject has been obtained, and a Farmers' Bulletin containing the essential details of the business has been issued and is now being distributed. It is believed that in regions suited to the business fox farming may be undertaken by farmers and others with excellent promise of success and that it will yield satisfactory returns for the investment of the necessary capital, time, and labor.

RELATION OF BIRDS TO AGRICULTURE.

Every year witnesses an increase in the number of sportsmen who pursue our game birds, every species of which plays a more or less

important part in destroying insect life and preserving the balance of nature; and this, too, while the reclamation of vast tracts of wild land for agricultural and other purposes encroaches on the breeding grounds of game birds, which are thus becoming fewer in numbers, while the demand for them becomes greater and greater. Many of our insectivorous birds also are killed for food, despite the fact that State laws almost everywhere within our borders prohibit such slaughter. With these and other forces making against the welfare of our birds, it becomes doubly important to use every means in our power not only to prevent the reduction of useful species but to increase their numbers whenever and wherever possible.

RELATION OF BIRDS TO THE COTTON BOLL WEEVIL.

As in previous years, investigations were carried on for the purpose of ascertaining what birds habitually eat the boll weevil. Ten additional species were found to feed on the weevil, bringing the number now known to prey on the pest up to 54. A report on the subject—in the nature of a report of progress—has been issued and widely distributed. Though based chiefly on investigations in Louisiana, the recommendations apply equally well to the whole cotton-producing area. As in previous reports, special attention is directed to the birds that feed on the weevil, and their care and protection are urged as the duty of every citizen, whether or not directly interested in the growing of cotton.

RELATION OF BIRDS TO FRUIT RAISING.

An accurate knowledge of the relations of birds to the orchard is peculiarly important that the orchardist may know his friends from his enemies, especially since among the birds that seem to be enemies are some whose services in destroying noxious insects more than compensate for the toll they levy on the fruit. Much attention has been paid to this subject in its relation to the west coast, where the industry of fruit raising is each year becoming more and more important, and the stomachs of more than 600 birds, including many of great economic value, have been examined and the contents determined. The work has been pushed as rapidly as possible, and the second and final part of a report on the birds of California in relation to fruit raising is now nearly ready for the press.

GEOGRAPHIC DISTRIBUTION.

During the year marked progress was made in this branch of the work, and much information was gathered in the field regarding the

distribution of trees and shrubs and the distribution, abundance, and habits of our native birds and mammals, which information serves as the basis for constructing the maps of the life and crop zones of the United States.

Work on the life zones of California was pushed with a view to the early publication of a life-zone map of the State, and the southern part is nearly finished. Work was done also in Oregon, North Dakota, Nevada, Arizona, New Mexico, Louisiana, and northern New England, and the results are to be incorporated in a new edition of the life-zone map of the United States now in course of preparation. The biological survey of Colorado was nearly completed, and the map and report on the work are now far advanced.

Revisionary studies of the whitefooted mice and American rabbits were completed and are now ready for publication.

The study of the migrations of birds was continued, and a bulletin was completed on the "Distribution and Migration of North American Shore Birds." This bulletin was prepared with special reference to the needs of legislation respecting this important group of food birds.

GAME PROTECTION AND INTRODUCTION.

The conservation of the birds and mammals of the country is nearly, if not quite, as important to the National welfare as the conservation of any other of its natural resources. Not only do our game birds and animals furnish a food supply of great value, but their pursuit offers a healthful and attractive pastime. Until recently the protection of birds and game has been left to the separate States, but the Biological Survey, by authority of the act of May 25, 1900, and other recent legislation, has been enabled to cooperate largely in this work. Already, with extremely limited appropriations, an influence has been exerted that has borne fruit in greatly improved protection, more effective enforcement of game and bird laws, increase of public interest in the conservation of the native fauna, abolition of the destruction in this country of birds for millinery uses, and decrease of excessive killing of game for market. This should be regarded, however, as merely a promising beginning, and I strongly recommend that the work be placed on a footing commensurate with its importance.

The present means by which the Biological Survey controls or influences bird and game protection are: (1) By supervising bird and game reservations; (2) by supervising interstate commerce in game; (3) by supervising the importation of wild birds and mammals from foreign countries; (4) by cooperating with officials, organizations, and individuals concerned in the protection of game and birds, and

(5) by furnishing information by means of publications and correspondence concerning the preservation of game and birds.

The operations of the year may be briefly summarized as follows:

BIRD RESERVATIONS.

Nine new bird reservations, making a total of 16, were created by Executive order—located off the coasts of Florida, Louisiana, Oregon, and Washington. Wardens were appointed for the Oregon and Washington reservations, and one for the Florida reservations (five in all). The large colonies of birds that frequent these island reservations will in future be protected and may be confidently expected to increase rapidly.

SUPERVISION OF IMPORTATIONS.

The usual careful scrutiny of all consignments of wild birds and mammals imported into the United States was maintained throughout the year. Two mongoose—animals specifically prohibited from entry by the act of May 25, 1900—were refused admission at New York in January, and in February a consignment of song thrushes designed for liberation on Coney Island, and 200 skylarks to be liberated in California were also denied entry, owing to the danger of these European birds becoming pests in this country, as they have in Australia and New Zealand. Birds and mammals are entered principally at New York. Of 103 consignments inspected 99 arrived at that port. It may be noted that the total cost of inspection, by means of which this large country is guarded against the danger of the introduction of animal pests, is less than $1,000.

The number of birds imported into the country continues to grow, and this year reached a total of about 450,000, consisting, as usual, mainly of canaries. The importation of eggs of game birds for propagation shows a decided falling off, the total number brought in being only 714. Especial interest attaches to the importation of European partridges for stocking covers. The number brought over was 7,783, an increase of more than 100 per cent over the importations of the previous year. This apparent growth in popularity of the partridge of Europe as a game bird for America is readily explained by the decrease of two of our own important game birds—the bobwhite and ruffed grouse—both of which have recently suffered severely from climatic vicissitudes.

COOPERATIVE WORK.

The cooperation of the Biological Survey with game officials and organizations is constantly sought, and during the year aid was extended the game officials of Califorina, Idaho, Illinois, North Dakota, Texas, Washington, and Wisconsin.

In my last report mention was made of the prosecution of two noted elk-tusk hunters. The men were convicted at Fort Yellow-

stone, September 10, 1907, of violation of the Yellowstone Park act, and were sentenced to pay costs of nearly $1,000 and serve a term in jail. This punishment, together with subsequent indictments of the remaining members of the party, has effectually broken up tusk hunting in the vicinity of the Yellowstone National Park.

Through cooperation with county authorities in southern California the spread of the English sparrow to the great fruit-raising section of that part of the State has probably been checked, and after a few small colonies are destroyed it is hoped that the bird can be excluded indefinitely from this region.

INFORMATION.

One of the most important phases of the work consists in the dissemination of information concerning game birds and animals and the steps taken to preserve them. This work is done largely through correspondence, but, in addition, publications are widely distributed containing annual digests of the game laws and other protective measures, or relating to special and important phases of game and bird protection.

DIVISION OF ACCOUNTS AND DISBURSEMENTS.

The constantly broadening scope of the investigations conducted by the numerous Bureaus of the Department in response to the urgent demands of the country at large has naturally resulted in a steady and vigorous growth in the amounts appropriated therefor by Congress from year to year. The importance of the Division of Accounts and Disbursements has therefore steadily increased, not only in connection with its function of properly disbursing the Department funds, but also because of the fact that, being charged by law with the administration of the fiscal affairs of the Department in their broadest sense, it is called upon to superintend and direct the preparation of all of the special and annual fiscal reports required by legislative enactment. Among the more important of these reports, already considerable in number, may be mentioned the annual estimates of appropriations, the annual report of expenditures, the annual report of traveling expenses of employees in the District of Columbia, and the comparative three-year report of expenditures.

To carry on the work of the Department of Agriculture during the fiscal year ended June 30, 1908, Congress appropriated the sum of $13,123,040, an increase of $1,940,300 over the preceding year. Of this appropriation $8,537,290 covered the ordinary expenses of the Department, $3,000,000 the permanent annual expense for meat inspection, $1,152,000 the agricultural experiment stations, and $433,-750 the printing and binding done under the Public Printer.

The disbursements of the Department for the fiscal year 1908 amounted to $14,148,329.29, and the greater part of the balance of

$668,462.34 will be required for the settlement of outstanding liabilities. The apparent excess of disbursements over the appropriations for this fiscal year is due to unexpended balances, amounting to $1,693,751.63, brought forward from "Administration, etc., Forest Reserves," and other special appropriations.

The amount paid for rent of buildings in the District of Columbia for the several branches of the Department was $65,705.

All accounts for the fiscal year 1906 having been settled, the unexpended balance of appropriations for that year, amounting to $196,619.10, was covered into the Treasury on June 30, 1908. The account for the fiscal year 1907 is still open.

The amount estimated for the fiscal year 1910 in the regular appropriation bill is $14,610,626, which includes $720,000 for agricultural experiment stations. In addition there will be a permanent appropriation of $3,000,000 for meat inspection, a permanent appropriation of $624,000 for additional allotments to agricultural experiment stations under the Adams Act, and $510,000 for printing and binding to be done under the Public Printer, making a grand total of $18,744,626, which is an increase over the fiscal year 1909 of $3,084,520, or 19.7 per cent. Of this increase $2,095,300 is for maintenance and improvements of the National Forests, and the balance, $989,220, is distributed among the other Bureaus and Divisions of the Department.

To sum up the fiscal affairs, it may be added that the principal items of increase each year are for the maintenance and improvement of the National Forests and for carrying into effect the provisions of the food and drugs act. In connection with the expenditures for National Forests, the offset of revenues from the sales of timber and grazing should be taken into consideration. During the fiscal year ended June 30, 1908, these amounted to $1,839,374.92. Since July 1, 1907, these revenues have been deposited in the Treasury to miscellaneous receipts, while prior to that time they were used for the maintenance and improvement of the National Forests, so it will be seen that the National Forests are practically self-supporting.

At the present time the total area of our National Forests is 167,027,319 acres, and the estimated cost of maintenance 2.73 cents per acre, a very small amount when compared with the cost of maintaining forests abroad. France expends annually upon her state forests 95 cents per acre, Switzerland $1.32, Prussia $1.58, and Saxony $2.32. These countries are named because in them the management of the forests is most profitable in products.

In view of the fact that the Congressional Committee on Expenditures in the Department of Agriculture, in its sittings during the last session of the Fifty-ninth Congress, went so thoroughly into the dis-

bursement of the Department for the fiscal year 1906, and found as a result of the examination that every expenditure involved had been properly made, no Congressional inquiry regarding the 1907 expenditures was conducted, although the report of expenditures for that year was prepared as usual by the Department.

DIVISION OF PUBLICATIONS.

During the past fiscal year 1,522 publications were issued, containing 58,510 printed pages. Of these, 477 were new publications, 998 were reprints, and 77 were publications of the Weather Bureau. The total number of copies of all publications printed during the year was 16,875,516. These figures represent but a slight increase over the corresponding figures for 1907. There was, in fact, an actual decrease of 74—or about 14 per cent—in the number of new publications, the increase being entirely in reprints to meet the demands for copies of publications already issued.

By careful revision and condensation, by the elimination of unimportant matter, by checking hasty or ill-advised publications, by cutting out unnecessary illustrations, and by limiting the size of editions, the Division of Publications has sought to promote economy in publication work, and with marked success, as the foregoing figures demonstrate. It should be borne in mind that a saving of printing funds can only be effected by a multitude of small economies, since, in the nature of things, no large economies are possible. Any large curtailment of printed matter would cripple the Department's efforts to educate and enlighten the public. The investigations and experiments made by the scientists and experts of this Department are valuable only as their results are made public; and the reports, bulletins, circulars, and periodicals issued by the Department constitute by far the most satisfactory and effective means of giving these results to the world. It would indeed be idle to spend large sums of money in making important investigations unless full and accurate reports of the same are given wide circulation.

DISTRIBUTION OF FARMERS' BULLETINS.

It is the Department's established policy to make the widest possible free distribution of Farmers' Bulletins, written in simple, popular style and printed in cheap form. During the past year 26 new bulletins were added to the list, bringing the total number in the series up to 327. Of these new bulletins more than three-quarters of a million copies were issued, and the reprints of earlier bulletins, for which there is a strong and steady demand, made the grand total of Farmers' Bulletins issued considerably above 6,000,000 copies.

For many years Congress, in appropriating for the publication of Farmers' Bulletins, has provided that the major part (usually four-fifths) of the copies printed should be allotted to Senators, Representatives, and Delegates for distribution among their constituents. It has invariably happened that some Members of Congress called for only a part of their quotas, leaving the remainder in the document and folding room of the Department. To prevent the accumulation of these unused residues and at the same time to enable the Secretary to place these bulletins where they would serve their intended purpose, Congress, prior to the year 1907, uniformly provided that these unused residues of Congressional quotas should revert to the Secretary for distribution after a fixed date. Under this provision the Secretary was able each year largely to supplement the insufficient supply of Farmers' Bulletins allotted to him.

SALE OF DEPARTMENT PUBLICATIONS.

The year's records of sales of Department publications by the Superintendent of Documents again demonstrated the great popularity of the reports and bulletins of this Department, and the wisdom of providing for their sale and the use of the proceeds in printing additional copies. During the year the Superintendent of Documents sold 94,626 copies of different publications of this Department and received therefor $14,174. The number of copies sold was nearly three times as great as in 1904, and 23,000 more than in 1907. The sales of this Department's publications also exceeded those of all the other Departments combined by about 33,000 copies.

SALE OF ELECTROTYPE PLATES.

It is very gratifying to report that the Public Printer has decided that the agricultural experiment stations, being maintained, in part at least, by the Federal Government, may obtain from him, under the law of January 12, 1895, electrotype plates from the original plates used in printing Department publications at the cost of electrotyping only, 66 cents per page. Under this interpretation of the law the stations can, and no doubt will, frequently procure plates of this Department's publications which contain the results of cooperative work or which may be of special value to them, and will reprint and distribute the same, thus supplementing the distribution made by the Department, which is often very much restricted on account of insufficient funds for printing. If a similar concession could be made to State governments it is quite likely that State officials for agriculture would also reprint many of our publications without expense to us, thus insuring a much wider dissemination of the valuable information in our bulletins than we can otherwise ever hope to secure.

BUREAU OF STATISTICS.

INTERNATIONAL INSTITUTE OF AGRICULTURE.

The International Institute of Agriculture, established under the patronage and through the efforts of the King of Italy in 1905, will be practically organized in the winter of 1908–9. This institute is sustained by forty-six countries, and the membership of the United States is established by the treaty of January 29, 1908. The supreme governing body is the General Assembly, and among the delegates from this country are two representatives from this Department—C. C. Clark, associate statistician of this Bureau, and George K. Holmes, statistical scientist in charge of Investigations of Production and Distribution. The Statistician and Chief of the Bureau, Victor H. Olmsted, has been designated as the representative of the United States for the purpose of supplying information to the institute.

Among the purposes of this institute are the collection, study, and publication of statistical, technical, and economic information concerning farming, both vegetable and animal products, the commerce in such products, and the prices prevailing in the various markets; the ascertainment of the wages paid for farm labor; the publication of information concerning new diseases of vegetables which may appear in any part of the world; the publication of information concerning agricultural cooperation, insurance, and credit; and the submission to the adhering governments of measures for the protection of the common interests of farmers and for the improvement of their condition.

INVESTIGATIONS OF PRODUCTION AND DISTRIBUTION.

The organization of the Bureau of Statistics has undergone a change so far as it relates to the division formerly known as "Foreign Markets," the work of which has become larger in scope. This division is now concerned with Investigations of Production and Distribution. It studies the production of wealth on farms, the distribution of farm products at home and abroad, and the economic conditions pertaining to the agricultural element of the population. The scope and variety of its work are indicated by such subjects as the production and consumption of meat and foreign markets for the national surplus of meat; farmers' cooperative organizations for insuring against loss by fire, for buying supplies, for selling products, etc.; the production and consumption of wheat in the chief countries; the number of domestic animals in most of the countries of the world; the foreign trade of the United States in agricultural products; crop production in many countries; agricultural exports and imports for all countries for which the information is published; the progress and improvement of agriculture in the United States; changes in farm

values and the causes therefor, and the transportation of farm products by wagon, rail, inland waterways, and ocean.

THE BUREAU'S PUBLICATIONS AND LIBRARY.

The branch of the Bureau formerly known as the Miscellaneous Division has also been reorganized, and has been named the Editorial Division and Library. This reorganization was made necessary by a notable increase in the number of publications issued from the Bureau; a constant increase in the number of requests, from all classes of the public, for statistical information; and continuous accessions to the Bureau's library of foreign, Federal, State, and municipal statistical literature.

The functions of the division in respect of the Bureau's correspondence have involved extensive and diversified search among statistical and other publications for the purpose of responding to hundreds of requests for varied information concerning foreign and domestic agricultural areas, yields, numbers of farm animals, cost of production, prices of and commerce in agricultural products, fiscal laws relating to commerce and production, migratory movement of farm laborers, use of agricultural products, number of farm implements in use, and divers other phases of the agricultural industry. Compilations have also been made in this division during the year for publication in the Yearbook of statistics of the world's production by countries of corn, wheat, oats, rye, barley, and flaxseed.

The statistical library has now increased to about 10,000 volumes, and, in point of the number of volumes devoted more or less exclusively to statistics of agriculture, is probably exceeded by few similar collections. The bulk of the collection consists of constantly growing sets of annual publications, but a large number of daily, weekly, and monthly foreign and domestic periodicals are also received, either through exchange or through purchase. The library has been rearranged and reclassified, and a thorough revision and wide extension of the card-index system is well under way toward completion. The especial object of this work has been to make easily and quickly accessible the wealth of statistical data relating to the agriculture of the various countries of the world now in possession of the Bureau. The exchanges and trade journals have also been catalogued, so far as statistics of agriculture are concerned, thereby affording prompt access to current statistical literature of the day not available in annual publications.

NEW QUARTERS FOR BUREAU.

The entire Bureau is now assembled in the large hall in the old administration building vacated by the Department's Library, while the fifty or more clerks engaged in the compilation and tabulation of

the reports of the county, township, and special correspondents used in the preparation of the Bureau's crop reports are concentrated in one room.

CROP CORRESPONDENTS.

The lists of correspondents which the Bureau maintains for the purpose of collecting crop statistics have been improved and augmented by the addition of names of reliable and representative farmers named by Members of Congress from among their constituents, in ready response to requests from the Statistician, while those correspondents who have failed to furnish prompt and full reports have been dropped. These changes have resulted in a material improvement, so that the average number of reports received in time for tabulation had in June increased to over 70 per cent. The lists now include 150,000 active correspondents.

CROP REPORTS ISSUED ON EARLIER DATES.

The monthly crop reports during the year have been published earlier and nearer the dates to which they relate. The reports as to cotton relate to the 25th of the month, and were formally published on the 3d of the following month; this year their publication on the 1st or 2d has been secured, and it is believed that the date of publication may hereafter be made not later than the 1st of each month. The reports as to grain and other products relate to the 1st of each month, and have been formerly published on the 10th. This year their publication has been made on the 8th or 9th, and it is expected to secure their publication not later than the 7th or 8th of each month. The earlier publication of the reports has been secured by simplifying methods of tabulation and improving the organization of the Bureau.

CROP REPORTING BOARD.

The plan of intrusting the final preparation of reports to a Crop Reporting Board has been continued, and after three full years of trial it has been demonstrated to be an excellent and satisfactory method. It avoids placing all the strain and responsibility on one man, and secures the benefits of consultation and a consensus of judgment among men who have been on the ground.

The Crop Reporting Board is composed of the Chief of Bureau, as chairman, and four other members chosen anew each crop-reporting day from among the statisticians and officials of the Bureau, including special field agents and State statistical agents who are called to Washington for the purpose. The personnel of the board is changed each month. The meetings are held in the office of the Statistician, which is kept locked during the sessions, no one being allowed to enter or leave the room or the Bureau, and all telephones are disconnected.

SPECIAL INVESTIGATIONS.

During the past year the Bureau began the collection of information concerning farmers' cooperative organizations, of which there are an immense number in this country, embracing more than half of the farmers. This undertaking will require several years.

A compilation of the statistics of agricultural imports of the United States, beginning with 1851, was completed. A similar compilation for agricultural exports was made five years ago, and recently the statistics of the re-exports of agricultural imports, or the so-called "foreign exports," were compiled for the same period of years, so that the statistics of the entire foreign trade in every agricultural community for more than half a century will soon be made available to the public.

An exhaustive statement of the acreage, production, and foreign trade in tobacco of the American colonies and of the United States from the earliest times to the present year was undertaken and nearly accomplished.

An extensive investigation of the production, trade, and supply of wheat in principal countries was commenced. The plan is to give special attention to conditions in countries which export wheat and to the consumption and markets in the principal importing countries.

A compilation of the statistics of imports of farm products into the Netherlands for the years 1904–1906 was prepared. The quantity of durum wheat exported from the United States in the fiscal year 1907 was ascertained from reports received from correspondents at the leading grain markets and seaports. What is substantially the world's production of wool was ascertained with much difficulty for inclusion in the agricultural statistics of the Yearbook of 1907. This is the first publication of this information by the Department.

STATISTICS OF TOBACCO BY TYPES.

The Bureau is bringing to completion a plan by which it is hoped to secure statistics of tobacco production by types. The State is the smallest unit or geographical division for which the Bureau at present issues detailed reports comparable with similar reports on other products which have been prepared for a long series of years. By the proposed method there can be secured statistics of the amount of each of the different types of tobacco grown in the States where more than one type of tobacco is grown. In the New England States, New York, Pennsylvania, Georgia, Florida, and Wisconsin, where the type of tobacco grown is coextensive with State lines, the amount of each type may be estimated, but in the States of Kentucky, Tennessee, Ohio, Virginia, and the Carolinas, where more than one distinct type grows within the State, it is very difficult to draw a line between counties that produce different types. In order to overcome this handicap this Department has entered into cooperation with the

Treasury Department, through its Bureau of Internal Revenue, which has inserted in the reports made by dealers in leaf tobacco a requirement for a statement of the amount received from farmers. By these data the Bureau will be enabled to check the annual reports and to secure a valuable statement by types.

DEPARTMENT LIBRARY.

The Library has been moved into the basement of the east wing of the new Department building, where it is commodiously housed in 18 rooms, originally designed for laboratory uses. It is of interest to note that at the time of moving the Library contained 100,000 books and pamphlets, whereas when it was first established in the old building in 1868 it contained less than 1,000 volumes. It is also matter for congratulation that this collection of books of such great value to the agricultural interests of the country is now stored in a fireproof building. In the work of preparing catalogue and index cards, and in all other usual lines of work, the Library has had a very successful year.

OFFICE OF EXPERIMENT STATIONS.

RELATIONS WITH THE AGRICULTURAL EXPERIMENT STATIONS.

Twenty years have passed since the Office of Experiment Stations was established to act as a general agency for the promotion of the interests of the agricultural experiment stations, which were then being organized on a National basis in accordance with the provisions of the Hatch Act. Although at the outset that Office had no authority over either the work or the funds of the stations, and even now exercises only a very limited control, it has nevertheless been an important factor in promoting their growth and development. By collecting and disseminating the results of their work, it has done much toward extending their influence throughout this and other countries; by collating the work of similar institutions throughout the world it has brought our stations into close and helpful touch with the whole field of agricultural science; by setting high standards of organization and work, it has led the stations to make constant progress in establishing themselves on firm foundations and increasing the efficiency of their operations; by tactful, yet cordial, criticisms of their work and expenditures, it has done much toward strengthening the weak places and effecting a wise and satisfactory use of the public funds intrusted to the stations.

Its relations with the stations have never been more cordial than they are at present, and its influence never broader nor more potent. The scrutiny which the Office makes of the stations' work as related to their use of Federal funds is now more extended and painstaking than ever before. Since this is made, however, in a helpful spirit, the stations generally recognize that it is calculated to promote their best

interests and stimulate them to more thorough work for the benefit of American agriculture.

More than half of the stations were established in 1888 or the previous year as a result of the passage of the Hatch Act, and nearly all of those which had been previously established by the States were reorganized at that time on a broader basis and with greatly increased resources. That year was therefore the beginning of experiment-station work in a National way and on the scale we now know it.

This period has been one of remarkable progress in the development of agriculture as a more rational, enlightened, and progressive industry, and also in the attitude of the farming people toward experimentation and education in agriculture. It has demonstrated the practical value of the experiment station, has shown its fundamental importance in developing a basis for teaching agriculture, and has established it firmly as a public institution.

This period has also been one of experiment in the development of these institutions and in determining what should be their field and function. The demand for practical advice and directions, and for simple tests which it was expected would answer local questions of profit or expediency, was prominent at the outset, and there was frequent disappointment that answers could not be quickly given to questions relating to the whole field of agriculture. The limitations of the fund of reliable information at hand at that time which could be drawn upon for such purposes soon became apparent, as did also the dangers of drawing hasty deductions from superficial tests and short trials. Gradually the public came to realize the need of more substantial and fundamental studies which should deal with the principles and follow more nearly the methods of scientific investigation in order to give results of more permanent value and more general application. As a result of this development of the stations' work, it has come about that the stations, and the colleges with which they are connected, are now in a position to do satisfactorily what they were really forced by circumstances to attempt at the outset, but were unable to accomplish in all cases.

The stations have developed a vast fund of practical information, much of it resting upon a scientific foundation, and have developed their special methods of work. But the dissemination of this information and its demonstration to the farmer have, to some extent, called for a special corps of workers. The supply of competent men to carry on experiments and investigations has never fully equaled the demand, and hence the pressure for their investigations has fixed distinct limits to the time which they could spend in the extension of their work to the farmer. The demand for assistance of a direct nature and the need of various forms of instruction and demonstration have increased year by year. As a result of this condition there has been a sharper differentiation of duties, and the working

staff of the station has been relieved, to a large extent, from other forms of activity. Special workers have been provided to look after the teaching work of the college and to do much of the demonstration work and local experimenting, leaving the investigators more largely to their special duties. This broader organization has increased the efficiency of each branch of the work.

The stations are doing more scientific work and at the same time a large amount of practical work. They are carrying their studies more thoroughly over the State and in this way reaching a larger proportion of the farmers and a larger proportion of their problems. The scientific researches inaugurated by the stations under the Adams Act are already pointing, in many instances, to ultimate practical results of fully as great value as those derived from much of the more superficial work and are laying the foundations of the industry broad and deep.

There has been steady progress in the providing of better facilities for the stations and their work. This is true, not only of the buildings which have been provided by the States, but of the equipment which has been furnished and the specially trained men who are being enlisted. These buildings are often among the largest and best which are found on the college campus, and are equipped in a thoroughly modern manner. The States have continued to make increasingly liberal appropriations for maintenance, and in a number of cases have added special farms and branch stations for studying the problems of a section requiring particular attention. These branch stations are at present conducted on a much more efficient basis than the original substations, which sprang up soon after the passage of the Hatch Act. Their work is correlated with that of the central stations, and is supplemented and strengthened by the latter through their laboratory investigations and the expert advice of their specialists. In fully half the States there are at present branch stations of a permanent nature, which serve to extend the work of the stations to different localities and to demonstrate the practical features of their results.

It has been decisively demonstrated that the granting of Federal aid to the States for the maintenance of the stations gave an immediate and tremendous impulse to the organization of these institutions throughout the country and led to increasing liberality on the part of the States in providing for their equipment and maintenance. The latest statistics of the stations gathered by the Office of Experiment Stations show that though the Federal aid to them was greatly augmented by the passage of the Adams Act, the increase in their local funds kept pace with this, so that now more than half the annual income of the stations is derived from sources within the States.

Four hundred and eighty-four station officers do more or less teaching in the colleges with which the stations are connected. During the year the stations published 459 annual reports, bulletins, and cir-

culars, which were supplied to over 774,000 addresses on the regular mailing lists. A larger number of stations than formerly supplemented their regular publications with more or less frequent issues of press bulletins and other special publications, and most of the stations report a large and constantly increasing correspondence with farmers on a wide variety of topics.

THE AGRICULTURAL COLLEGES AND SCHOOLS.

The recognition of agriculture as a teachable subject, having educational value comparable to that of any other scientific subject, is no longer confined to the institutions and men whose main work is along agricultural lines. Its recognition and advancement in college and school courses no longer depends solely upon those who might be expected to be prejudiced in its favor. It is now rated with other scientific and technical subjects as a suitable major for the doctorate in philosophy, not only in agricultural colleges and such large universities as Cornell and Wisconsin, where agriculture is regularly taught in undergraduate courses, but also in universities which do not include agriculture among undergraduate courses.

The progress made in agricultural education in the United States during the past eleven years as a result of popular demand stimulated by the work of the State agricultural colleges and experiment stations and of this Department is unprecedented in the history of the world. In 1897, when the present administration of this Department began, all but one of the land-grant colleges were in running order and doing excellent work, but their total income was only $5,000,000; to-day it is almost $15,000,000. The property of these institutions was then valued at $51,000,000; now at $96,000,000. Then there were less than 4,000 students in agricultural courses; now there are over 10,000. Ninety of the 1907 graduates of these courses accepted positions in the agricultural colleges and experiment stations or in this Department at salaries ranging from $500 to $1,700 and averaging $948.66. It is stated by presidents of the agricultural and mechanical colleges that of late the graduates of agricultural courses find remunerative employment much more readily than the graduates from engineering courses.

But the most rapid progress has been made in the field of secondary and elementary education in agriculture. In 1897 Minnesota had the only State agricultural high school and Alabama had just made provision for the last of its nine district agricultural schools. The teaching of agriculture in the public elementary schools was scarcely thought of. To-day there are 15 agricultural high schools of the Minnesota type and 40 other agricultural high schools receiving State aid, 16 privately endowed colleges and high schools giving instruction in agriculture, 115 State and county normal schools preparing young

people to teach agriculture, and, on our lists, over 250 public and private high schools and academies giving some instruction in agriculture. There are 16 institutions offering correspondence and reading courses in agriculture and 26 private or special elementary agricultural schools.

The National Education Association has organized a department of rural and agricultural education and has a standing committee investigating the desirability and feasibility of teaching agriculture in rural schools. The legislature of Massachusetts has created a commission on industrial education, which is giving much encouragement to the establishment of secondary schools of agriculture in the State. The constitution of the new State of Oklahoma requires the teaching of agriculture in all its public schools, and the legislature of the State has provided for four State normal schools with departments of agriculture, and an agricultural high school in each judicial district of the State.

In thirteen States the teaching of agriculture in the rural schools is now required by law. It is encouraged by State and county school officers and taught in some of the rural schools of thirty-one other States and Territories. Forty-four States and outlying possessions, then, are making some effort to teach their youth the underlying principles of our greatest productive industry.

Partly as a result of this remarkable growth of sentiment in favor of secondary and elementary instruction in agriculture in public schools, and partly in response to the stimulus given by the Nelson amendment, allowing the land-grant colleges to devote a part of their increased Federal aid to "the special preparation of instructors for teaching the elements of agriculture and the mechanic arts," about half of these institutions now offer training courses for teachers of agriculture ranging from summer courses of a few weeks to regular four-year courses, with additional graduate work.

This Department is aiding in the promotion of this great movement through all its different Bureaus and Divisions, but the Office of Experiment Stations is giving special attention to it. That Office is cooperating with the Association of American Agricultural Colleges and Experiment Stations, with the National Education Association and other educational associations and their standing committees, and with State and local school officers in the different States and Territories in preparing suggestive courses of study in agriculture, horticulture, and other related subjects, in developing suitable laboratory material and exercises for schools of different grade, and in securing suitable literature to supplement the agricultural text-books and manuals used in the colleges and schools. Many of the publications of this Department are used in this way.

The Director of the Office of Experiment Stations acted as dean of the Graduate School of Agriculture at its third session, as at the other sessions, and has continued to occupy an important position in the councils of different educational associations of National scope. His assistants are regularly engaged in reviewing and abstracting the literature of agricultural education and research from all over the world. At the same time they are selecting and working over such of this material as is suitable for use in the public schools and putting it in usable form for the teachers and pupils.

The Director and his assistants are also called upon to lecture upon methods of teaching agriculture at the Graduate School of Agriculture and at the summer sessions of State universities and State normal schools. One of his assistants this year spent the month of June in a summer school for teachers in Louisiana and July in a similar school in New Jersey. Another gave lectures on methods of teaching agriculture at the Graduate School of Agriculture at Cornell University and at summer schools for teachers at the University of Texas, University of Tennessee, Miami University in Ohio, and Massachusetts Agricultural College. These men are also called upon frequently to attend State meetings of teachers and other large conventions assembled for the consideration of educational problems.

Congress has granted a small additional appropriation for the work of the Office of Experiment Stations in relation to agricultural colleges and schools, which will enable the Office to increase the effectiveness of its organization to some extent, but not in proportion to the rapidly increasing demands made upon it by educational institutions throughout the country. It will not be possible to branch out along new lines, but it is hoped that with the aid and cooperation of other Bureaus of the Department, a beginning may be made in the preparation of two new classes of publications now much needed for the assistance of teachers and pupils in public schools: (1) Instructional publications or brief monographs giving reliable and up-to-date methods of performing certain agricultural operations, such as How to restore humus to the soil, How to prevent soil erosion, How to manage the wood lot, How to get a good stand of corn, How to make and apply Bordeaux mixture, etc., and (2) informational publications, brief monographs concerning the origin, distribution, and importance of leading agricultural crops, and the supply, distribution, and importance of our National agricultural resources. Publications of the first class are needed mainly by the schools in which agriculture is taught, but those of the second class, informational publications, are in demand from all classes of schools, city and rural, to supplement the text-books of geography, botany, zoology, and agriculture.

FARMERS' INSTITUTES.

The farmers' institute has developed until it has become a leading agency in the dissemination of agricultural information. Over 2,000,000 people are reported as having attended the regular institute meetings during the year and 164,000 the special institutes, while there was furnished by State and local authorities $318,000 for carrying on the work. The appropriations represent an increase of $44,000 and the attendance an increase of 415,000 over the previous year.

The growing popularity of this method of instruction is unmistakable evidence of a great desire among farming people for agricultural information, and is also an indication of the way by which this need may ultimately be met. While agricultural bulletins, periodicals, and books have done much to inform farmers respecting improved methods in the treatment of soils, animals, and crops, the absence of an effective agency to call attention to their contents and direct the farmer where to find the information he needs has prevented their being utilized to their fullest extent. The farmers' institute has devoted itself chiefly to selecting the valuable truths of science found in agricultural publications and to showing farmers their practical application in restoring soils, increasing crops, and improving animals. Information respecting agriculture has been accumulating to such an extent and is increasing so rapidly each year that serious attention ought now be given to discovering effective methods for introducing what is known into general practice. This is an immediate need, and the problem will have to be worked out before what has been done in the field of research can be fully utilized by farming people.

In the inauguration of both forms of instruction much remains to be accomplished which can best be done by some central agency acting as a clearing-house to collect, formulate, and disseminate information in ways not within the reach or the province of any local agency. It is in this capacity that the Office of Experiment Stations is working. For both the itinerant instruction and the instruction in schools it is bringing together information, formulating courses of study and plans of organization, and advising with the local officers in charge concerning their own particular plans and problems.

INSULAR STATIONS.

The efforts of the Alaska, Hawaii, and Porto Rico stations along the lines of diversified agriculture have been continued. The Alaska stations devote their principal efforts to live stock, horticultural crops, and cereal growing. The cattle formerly at the Kenai station have been removed to Kodiak and the two herds combined. The station now has about 60 head of registered Galloway cattle, which have

demonstrated their ability to withstand winter conditions by going through the last winter without any shelter except an open feeding shed. A large range is needed for the animal-breeding station, and a survey has been made of a suitable tract. The horticultural investigations at Sitka are quite promising. In the young orchard some of the trees have shown their first blooms, and a few varieties of cherries bore fruit this year. The plant-breeding work is being continued, and as but few varieties of apples have so far shown any indication of surviving Alaskan winters, experiments are being conducted in pollinating some of the most promising varieties with pollen from the native crab apple, and seedlings will be produced as fast as possible. During the past season some of the crosses between the wild and cultivated strawberry and the hybrids between the salmon berry and the cultivated raspberry bore fruit, and selection experiments will be conducted for the establishment of any desirable varieties. A species of willow which is well adapted to basketry has been introduced by the station and was found to grow exceedingly well. The cereal investigations are carried on principally at Rampart and Copper Center, where selections of the earliest ripening heads of every variety are being made. A severe frost again destroyed the grain crop at Copper Center, but at Rampart all varieties yielded well, as has been the case nearly every year since the establishment of the station in 1900. Work was actually begun in developing a station near Fairbanks, reserved for that purpose by executive order, March 22, 1906. About 10 acres were planted to oats and potatoes and arrangements made for clearing more land and for the erection of much-needed buildings. At the Copper Center station plant breeding with native grasses and leguminous plants has been begun, and about 90 species have been brought together for further study.

The Hawaii station continues its work in the diversification of agriculture in those islands. The experiments in shipping tropical fruits have been continued, and it has been demonstrated that pineapples, avocados, and similar fruits may be successfully shipped to any point within thirty days' direct communication with Honolulu. The rice investigations have been continued and extended, and the value of sulphate of ammonia and other high-grade fertilizers when applied to rice has been shown. The results of these experiments have already become well known and dealers in fertilizers report a marked increase in the sales of high-grade fertilizers to rice growers. The studies in Hawaiian honey made by the entomologist have resulted in the adoption of suggestions whereby a largely increased revenue is obtained by bee keepers. A study has been begun of the insects affecting live stock and suggestions made for the control of some of the more troublesome ones. Among the more promising of the newly developed agricultural industries of Hawaii is pineapple

growing, and the study of the soil and fertilizer requirements of this crop has been begun on a comprehensive scale. All the departments of the station will give attention to the problems connected with the cultivation and marketing of this fruit. The introduction of Chinese and Japanese matting rushes has been successfully made and the profitableness of growing these seems to be well established. An experiment in harvesting salt-marsh rice for hay has indicated that large quantities of such hay can be produced in Hawaii to take the place of the hay which is imported, to the amount of $350,000 worth annually, most of it coming from California. The experiments in tapping rubber trees have been continued, and, as showing the possibilities of rubber production, two Ceara rubber trees which had been tapped in July, 1907, when tapped again in January, 1908, yielded 6½ ounces of dry rubber in nine days. When it is considered that more than 600,000 rubber trees, 90 per cent of which are Ceara rubber, have been planted in Hawaii within the past three years, the importance of experiments in tapping and with coagulants for rubber latex may be appreciated.

The work in Porto Rico consists of experiments in plant and animal introduction and breeding, crop production, control of insect and fungus pests, reforestation, etc. Seedling pineapples and seedling sugar canes, some of which were originated at the station, and improved varieties of other important crops are under observation at the station. Experiments in breeding pigs and poultry have proved quite successful at the station and the surplus is sold to planters at fair prices. No difficulties have been met with in raising any of the improved strains and the demand is always in excess of the station's supply. Experiments in ensiling cane tops for feeding to cattle have indicated the practicability of using this extensive source of forage, most of which is now wasted. Experiments on the reforestation of denuded hilltops are being continued and some varieties of eucalyptus have been found that are well adapted to this purpose. Some of the introduced varieties of coffee are beginning to bear and it is now possible to pass judgment on their qualities. The common Porto Rican coffee has not met with a favorable reception in the continental portions of the United States, and it is believed to be a good policy to introduce the types of coffee which are demanded by the trade. The highly flavored Java coffees seem to retain their well-known characteristics when grown under Porto Rican conditions and coffee planters are taking a deep interest in this experiment and are planting the improved varieties as fast as seedlings can be supplied. The station's suggestions regarding planting, cultivation, pruning, etc., are being quite generally followed on the new plantations. The entomologist has been studying the life history of a number of troublesome insects and has worked out methods for the

control of some of them. Parasites of the eggs of the tobacco horn-worm, mentioned in the previous report, have been distributed in Porto Rico and also in sections of the mainland. A system of co-operative demonstration experiments has been successfully inaugurated which has proved very popular as a means for the dissemination of information relating to a more rational system of agricultural practice.

Preliminary steps have been taken for the establishment and maintenance of an experiment station in the island of Guam, and the conditions in that island are believed to be favorable for the restoration of agriculture and its development along more modern lines.

NUTRITION INVESTIGATIONS.

According to authority granted by Congress the reconstruction of the respiration calorimeter is proceeding, and reports on investigations made previously are being prepared for publication.

It is expected to take advantage of new features suggested by the work of others or devised by our experts to simplify and improve the respiration calorimeter in several important ways. The work is being rapidly pushed and the apparatus will be ready for use before the end of the fiscal year. Careful plans are being made for the utilization of the apparatus in lines in harmony with the general work of the Department. The investigations planned involve cooperation with other Bureaus and the supplementing, and not the duplicating, of their work, where it concerns the utilization of dairy products, cereal products, and other animal and vegetable foodstuffs produced on farms, on ranches, and in gardens.

With the aid of the respiration calorimeter it is proposed to study the relative ease of digestion of cheese made and cured in different ways, a line of work of the utmost importance in view of the experiments already completed, which have demonstrated the thoroughness of digestion and high nutritive value of cheese as an economical article of diet. It is also proposed to study with the respiration calorimeter the relative value of butter, lard, beef fat, olive oil, and other edible and culinary fats as sources of energy in the body, a matter on which data are much needed in considering problems now before the Department, and to make similar studies needed to round out the Department's work on the food value of cereal products and meat and meat products.

Studies made and in part reported have shown the value of fruits and preserves, evaporated fruits, and other fruit products, and of nuts and nut products, as integral parts of the diet, a matter which is of decided importance to all who are interested in the production of fruits and nuts and the manufacture of fruit and nut products. The

respiration calorimeter is essential for the measurement of factors which are at present imperfectly understood.

The estimates for the Department for the next fiscal year include an item for nutrition investigations which is merely sufficient to provide for the immediate management of the respiration calorimeter during experiments and the preparation of popular and technical reports of the investigations made with it. Other expenses necessarily incident to such work will be provided for from funds of other Bureaus which have sought cooperation in this enterprise, provided Congress grants such authority.

The work of the Department in nutrition investigations and kindred lines has a vital relation to the work of our agricultural colleges. In response to a widespread demand among farmers and other people these colleges are conducting courses in home economics in which instruction regarding the nutritive value of different foods and ways of handling and cooking them is an important feature. These colleges have for years looked to the Department for aid in this line and are now doing so more than ever. The agricultural colleges have been stimulated by a recent act of Congress to organize courses for teachers along this line as well as other branches of agriculture and mechanical arts. Secondary and primary schools all over the country are taking up this work and the demand for teachers and for information outruns the supply.

Recognizing the importance of the nutrition investigations of the Department in this connection, students, teachers, investigators, and individuals interested in such problems are turning to the Department in increasing numbers for information and suggestions. This is one phase of the great movement for the improvement of life in both country and city through education directly relating to home interests and the vocations of the people and the dissemination of information along such lines. It has long been understood that work of this character has been undertaken by the Department and the result has been that while we have recently had no funds for nutrition work, the demand for information has continued to increase. It is impossible to satisfy this demand unless funds are supplied for regular work of publication and dissemination of information. The Farmers' Bulletins which we have prepared on the nutritive value of vegetables, fruits, meat, bread, and other subjects relating to the nutrition work have been among the most popular of the series and the editions have run into the hundreds of thousands. These publications should be kept up to date and others prepared to cover subjects not already treated.

IRRIGATION INVESTIGATIONS.

As in the past year, the most pressing needs of the arid regions are practical information for settlers on the large areas now being

brought under ditch, and the checking of losses of water in its transportation to the place of use and in its application to fields. In view of this fact work has been concentrated on these two lines. Never before in our history has there been so great activity in the construction of canals and reservoirs to provide a water supply for our arid lands. The construction of these works is under the direction of trained engineers, while the preparation of the land to receive water, which in many cases involves an expense fully as great as for the works which supply the water, is left to the settlers who come almost entirely from sections where irrigation is not practiced and are consequently ignorant of irrigation practice. Realizing that the proper use of water is fully as important as the proper construction of works, we have made a special effort to make available for settlers in the arid region the same degree of expert knowledge regarding the performance of all the operations connected with irrigation that has been used in the construction of irrigation works. This is being accomplished by studying the practice of the older irrigated sections to get the benefits of their experience, and by experiments to get a more exact knowledge of the action of water in the soil and the effect of different methods of applying water and cultivating the soil. To make the results of this work available as soon as possible, many special agents have been employed to assist our regular force of experts. It is estimated that there is now under ditch and awaiting settlement fully 5,000,000 acres. To cultivate these lands will require 100,000 settlers. It is also estimated that each settler must invest at least $1,500 in cash in addition to his labor in establishing himself on a new irrigated farm, calling for an expenditure of $150,000,000, a very large part of which will be wasted if settlers are not given expert advice.

The magnitude of the losses of water in irrigation practice and the importance of checking these losses have been repeatedly mentioned in former reports. Careful observations indicate that not to exceed one-third of the water diverted from streams or stored in reservoirs is actually used by crops in the processes of growth. As the area which can be irrigated is limited by the water supply, not by the extent of available land, any preventable loss is an unnecessary restriction of the irrigated area. Some loss in unavoidable, some can be prevented only at great expense, but much can be done by a better adaptation of methods to the conditions of soil and subsoil without any noticeable increase in present cost. In no other way can so great an additional area be supplied with water at so small an expense. This saving, however, requires an accurate knowledge of the action of water on the soils of different types, and to secure this we are carrying on both tank and field experiments throughout the arid region.

The present activity in the construction of irrigation works in the West has resulted in a large call on this Department for general information as to water resources, water laws, irrigated crops, methods and cost of irrigation, and opportunities for settlement in the various States and Territories of the arid region. This is a legitimate demand and we are preparing to meet it by the publication of a series of brief bulletins giving such information, compiled in most cases by the State or Territorial engineers or by other local officials.

Settlement of the semiarid region by those who expect to engage in dry farming has continued with little check, but the experience of these settlers has increased the demand for information regarding the possibilities of developing small water supplies for the irrigation of limited areas in connection with the farming of large areas without irrigation. The farms established for securing such information and for demonstrating the methods of use and the advantages of irrigation have been maintained during the past year and should be continued. The water for the dry farms on the plains must be pumped from underground sources or stored from storm waters.

The practice of irrigation in the humid parts of our country is becoming more common every year, and the demand for information regarding methods adapted to that section has led to the placing of an experienced man in the East to study conditions and the methods best suited to them. Experiments have been begun for the purpose of testing the adaptation of the cheap western methods to conditions in the East, where the present methods, worked out by the truck growers, are very expensive. The value of the irrigation of meadows and of the use of sewage water on forage crops is being tested by experiment in several localities.

DRAINAGE INVESTIGATIONS.

Recent estimates made by the Department place the total area of unreclaimed wet lands in round numbers at 79,000,000 acres. With reference to their productive value as affected by their natural wet condition, these vast areas may be classified as follows:

(1) Lands which are permanently wet and are never fit for cultivation even during the most favorable years.

(2) Lands which afford pasturage for live stock, though the forage which they produce may be of indifferent quality.

(3) Lands which in their natural condition are subject to periodical overflow by streams, but which at other times produce valuable crops.

(4) Lands which yield profitable crops during seasons of light or medium rainfall, but which are wholly unproductive in seasons characterized by greater than the normal rainfall.

It is estimated that of the first class there are 52,000,000 acres; of the second class, 7,000,000 acres; of the third class, 15,000,000 acres, and of the fourth class, 5,000,000 acres. In addition to this area it is estimated that there are 150,000,000 acres of occupied farm land whose production would be increased 20 per cent, without additional labor in management or cultivation, were it judiciously drained.

The existence of these conditions suggest that immense agricultural possibilities lie before us in the reclamation of the so-called swamp lands, and also in the better drainage of lands which are now under cultivation. That marked attention is being given to this subject by landowners is evinced by the large number of inquiries received by the Department upon matters directly related to agricultural drainage.

The principal localities in which extensive work was carried on during the fiscal year ending June 30, 1908, are enumerated below:

Arkansas.—A survey of Camp Bayou near Wilmot, in Ashley County, was made, and plans and estimates were prepared for a system of main drainage ditches adequate for the reclamation of the district. Near Lonoke a small area in the upland-rice district was surveyed and a system of drainage by road ditches was planned designed to facilitate the drainage of the rice lands and improve the roads in that prairie region.

Colorado.—A preliminary examination of the San Luis Valley was followed by extensive field investigations to determine the feasibility of reclaiming by drainage large areas of land that were once under profitable irrigation, but whose value has been largely destroyed by the accumulation of excessive amounts of water and alkali. A preliminary investigation of the valuable fruit lands of the Grand River Valley which are injured by seepage was also made.

Florida.—A party spent the months from December to April in a continuation of the investigations of the Everglades carried on during the two previous years. All the natural outlets to the Atlantic Ocean, north of Miami, were examined to determine their fitness for improvement sufficient to afford adequate drainage channels for the relief of the Everglades and Lake Okeechobee. A possible route for a canal was located from the head of the Loxahatchee River to the lake, and levels were taken over the line. The lake was entered by going up the Caloosahatchee River, and the north and east shores of the lake were carefully examined.

Illinois.—In cooperation with the Illinois Geological Survey, an investigation was begun of the damage along the Little Wabash River and its tributaries caused by overflow of the rich bottom lands in time of flood, and of the best means of preventing such injury. An investigation was also made of the methods that have been put into use along the Illinois River for protecting and draining the valuable bottom lands by means of an elaborate and expensive system of diking and pumping.

Kansas.—The investigation of flood conditions along the Neosho River, begun during the previous year, was completed. A plan for the prevention of further injury by overflow of the valuable agricultural bottom lands was developed, consisting of a system of levees extending from Emporia to the Kansas-Oklahoma line. A method of doing the work was outlined and its cost estimated.

LOUISIANA.—A drainage district, including about 15,000 acres in Madison Parish, near Tallulah, was surveyed and plans were prepared for the improvement of the natural drainage channels. The construction of the proposed work is now being undertaken by the landowners interested. The landowners in a similar district near Mounds were assisted in carrying out their survey and preparing their drainage plans.

MINNESOTA.—The laying of nearly 9 miles of tile on the Minnesota Northwest Experiment Farm, at Crookston, was completed in November, 1907. This installation will test, in an experimental way, the effectiveness of tile in latitudes where the ground freezes to a depth of 6 feet or more in winter; also the relative merits in such a situation of cement and clay tile. The cost of all the different operations involved in draining farm lands in this region was carefully determined. A preliminary examination was also made of drainage conditions in McLeod County.

MISSISSIPPI.—Three projects in the Yazoo Delta were investigated. In Tunica County the McKinney Lake District, including 30,000 acres, was surveyed and plans were prepared for its drainage. In Bolivar County the natural channels of 120,000 acres of wet land were examined and recommendations were made for their improvement. Overflow conditions along the upper reaches of the Coldwater River were extensively investigated.

NEBRASKA.—Observations were continued on the tile-drainage experiment near Lexington. In the same neighborhood a survey was made for a proposed drainage district. In May, 1908, an extensive survey was begun of the Logan River to determine the best measures to be undertaken to prevent the extensive injuries to the rich agricultural bottom lands which now occur.

NORTH CAROLINA.—A survey of the Toisnot Swamp, near Wilson, was made and plans were prepared for the improvement of the natural channel sufficient to secure adequate drainage. A drainage survey of a portion of the Angola Bay Swamp, near Burgaw, was made at the request of the North Carolina Geological and Economic Survey, and plans were prepared for the construction of artificial ditches adequate for the reclamation of the area examined.

OREGON.—A tile-drainage experiment was installed near Albany, Linn County, to determine the effectiveness of under drainage in reclaiming unproductive, wornout wheat lands in Willamette Valley.

SOUTH CAROLINA.—In cooperation with the local landowners, a survey of Sampit Swamp, near Georgetown, was made and plans for the drainage of the swamp were prepared. A survey of the bottom lands subject to injury by overflow along the east side of the Congaree River, below Columbia, was made and plans were prepared for a system of levees to prevent further injury. In cooperation with the authorities of Clemson College, the Office of Experiment Stations assisted in the installation of a tile-drainage system on the Coast Lands Experiment Station Farm, near Summerville, by preparing plans for the system and furnishing an engineer to superintend the construction. This system will serve as an illustration of the value of tile drainage in the heavy coast lands.

SOUTH DAKOTA.—A survey was begun of the overflowed lands lying along the Vermilion River, near Centerville, with the object of determining the best procedure for protecting these lands from further injury.

UTAH.—Observations were continued upon the experimental drainage of irrigated lands in Box Elder, Cache, Weber, Davis, Salt Lake, Sevier, Millard, Emery, and Washington counties. Surveys were made for additional locations

where landowners desired to construct drains. The success of the drainage experiments in many places, especially in the northern part of the State, is leading to a large extension of drainage by individual landholders.

WYOMING.—In continuation of work begun in 1903, further investigations were made of the practicability of reclaiming by drainage lands in the Grey Bull Valley which had become injured by excess of water and an accumulation of alkali. In cooperation with the State experiment station, an experimental tile-drainage system was installed on the University stock farm at Laramie. This system will test the efficiency of tile in reclaiming wet and alkalied land, so that it will again be valuable for agricultural purposes.

GENERAL TECHNICAL INVESTIGATIONS.—As opportunity offered special studies have been made in several lines in which information is needed by drainage engineers. An investigation was begun of the construction and maintenance and of the carrying capacity of drainage ditches in the southern Mississippi Valley States. Similar data were also collected in Illinois and Iowa. A study of the drainage of peat and turf lands in Indiana, Illinois, Wisconsin, and Minnesota was inaugurated. Studies relating to the reclamation of tide lands along the Atlantic coast from New Jersey to Georgia were carried on.

DISSEMINATION OF INFORMATION.—In addition to the extensive correspondence carried on continuously from the Washington office with inquirers for information on the subject of drainage, various members of the scientific staff made addresses and took part in a considerable number of public meetings held to consider this subject.

OFFICE OF PUBLIC ROADS.

RELATION OF ROADS TO AGRICULTURE.

For many years the Department has endeavored to impress upon producers and consumers the close and intimate relationship of the public road to agriculture, and while endeavoring by practical demonstration and scientific experiment to improve methods of construction and maintenance, has lost no opportunity of awakening the public to a proper appreciation of the great economic importance of road improvement and the necessity for reform in the management of the public roads. Some conception may be had of the immensity of the task by considering the fact that there are 2,151,000 miles of road in the United States, a sufficient length to encircle the globe at the equator with 86 parallel roads. The total expenditure upon roads for 1904 was nearly $80,000,000. At that time about 38,600 miles had been surfaced with stone, 108,200 with gravel, and 6,800 with special materials, making the whole mileage of improved roads only 7.14 per cent of the total. An effort has been made by the engineers of this Department to estimate the mileage of improved roads in 1908, and the total value of all roads, including bridges and rights of way. Taking the 1904 figures as a basis, and assuming that the macadam roads have increased 12.5 per cent, the gravel 15 per cent, and those surfaced with special materials 25 per cent, we have 43,450 miles of macadam, 124,468 of gravel, and 8,512 surfaced with special ma-

terials. The cost of the macadam has been estimated at $4,500 per mile, of the gravel at $1,500, and of other surfacing materials at $1,000.

There is about 1,975,000 miles of earth road, which it is estimated has cost for grading, culverts, bridges, and all other items of expense an average of $500 per mile. The right of way, which has been estimated at 40 feet in width for the entire mileage, is worth at the average acreage valuation as given in census reports $342,000,000, making a total estimated cost of $1,720,339,000 for all the roads of this country. Over these roads at least 250,000,000 tons of freight are hauled every year to railroads, not including the immense tonnage hauled to wharves and docks for water shipment, which we are unable to estimate. The data collected by the Department indicate that this hauling is done at an average cost of not less than 23 cents per ton per mile, and that the average haul is about 9 miles, which goes to show that the transportation over the public roads to the railroad represents an annual cost of over half a billion dollars. Hauling in France is done in many cases at as low a cost as 7 cents per ton per mile, and the average there is probably not more than half of the average for the United States. The selling price of farm products is largely determined by factors beyond the control of the farmer. His prosperity must be measured by the margin of profit above the cost of production and of transportation; and it is only when the great agricultural population awakens to a realization that the road problem is a farm problem that we can look for substantial progress in this important branch of transportation.

EFFECT ON EDUCATION.

The relation of the public roads to education is one which has largely been overlooked. It is a more or less well-known fact that we have in all of our States a number of illiterates. While there are a number of contributory causes to illiteracy, it is significant to note that in four States where the average percentage of improved roads is 30.55 the percentage of white illiterates is only 0.34 of 1 per cent of the total population, and in four States in which only 1.51 of the road mileage is improved the per cent of white illiterates is 4.76. It is probable that bad roads are partly a cause and partly an effect of ignorance, but it certainly appears that the two are closely related.

HIGHWAY ENGINEERING.

Our colleges and universities are realizing that special provision must be made in their engineering departments to meet the increasing demand for men specially qualified in highway engineering. The

usual course in civil engineering does not provide graduates capable of immediately taking up and directing highway work. Accordingly, the Department has cooperated with educational institutions and urged the establishment of courses in highway engineering or the modification of civil engineering courses so as to provide the necessary instruction. The University of Washington has established a chair of highway engineering, to which an engineer of the Office of Public Roads of this Department has been appointed, and many other colleges are now making definite progress along this line. In addition, the Department has for several years successfully carried out a plan of appointing each year a small number of graduates in civil engineering and giving them thorough and practical training in highway work for a period of one year. This is not gratuitous instruction on the part of the Government, as the young men, while receiving a small salary and valuable instruction, are, on the other hand, rendering service to the Government. At the end of one year these students may be retained in the service without further examination and promoted to the position of assistant engineer. The plan has worked out exceedingly well, and a number of young engineers have passed from the Government service to important positions in State and county road work.

SAND-CLAY ROADS.

In many sections of country, almost entirely without road-building rocks, the cost of macadam roads is prohibitive. Sparse population and lack of funds prevent the building of hard roads in many cases. To meet the needs of such localities, the Department has by research and experiment endeavored to devise methods of construction which would utilize to the best advantage the materials immediately available. For many years the sand-clay method has been in successful operation in various Southern States, and the Department has endeavored to bring it more and more into general use. The past summer witnessed the beginning of experiments with the sand-clay method at Englewood, Kans., and later in the summer at Dodge City, Kans. The people at these Kansas points are enthusiastic over the possibilities of the sand-clay road, and at this stage of the work the indications are that the experiment will prove as successful on the Great Plains as in the South. If our hopes are realized in this work, a tremendous benefit will result not only to Kansas, but to many of the trans-Mississippi States.

BURNT-CLAY ROADS.

For several years the Department has been conducting experiments with burnt clay in the Mississippi Delta region. While the experi-

ments have not been uniformly successful, the Department feels justified in announcing that burnt-clay roads are entirely feasible, and under favorable conditions are almost as satisfactory as macadam. A burnt-clay road completed by the Office of Public Roads of this Department at Greenville, Miss., on November 4, 1907, withstood the trying climatic conditions of the winter and spring and an exceedingly heavy traffic, and showed very few signs of damage at the close of the past summer. Another burnt-clay road at Tallulah, La., constructed during the past summer, is now in excellent condition. The burnt-clay road will generally be constructed in sections of country where macadam materials are not available, and in such cases the cost will probably not exceed on the average one-third the cost of the macadam.

DUST PREVENTION.

The destructive effects of automobile traffic on macadam roads have occasioned much uneasiness, as many million dollars have been expended in this form of construction. The engineers of the Department have, in common with others in this country and in France and England, conducted numerous experiments with a view to determining the exact cause of the deterioration of macadam roads and to devising methods of treatment or construction which would effectually meet existing conditions. The materials used in the experiments by the Department have included, among others, tar preparations, asphalt oils, temporary expedients, such as calcium chloride, and several special preparations originated by the Office of Public Roads of this Department. Some measure of success has attended the work thus far, and it is hoped that much progress will be made within the next few years.

INTERNATIONAL BUREAU OF ROADS.

So important has the subject of road improvement become that an international road congress has just concluded its deliberations at Paris, France, which was participated in by the representatives of 29 governments, and at which nearly 100 valuable papers on various phases of the subject were presented. The most important outcome of this congress was the formation of an international bureau of roads, to be composed of two or more delegates from each of the governments represented at the congress. The purpose of this bureau is to collect and make available for all of its members all data of importance on the subject of roads in every country. It is gratifying to be able to state that the suggestion for such a bureau was made by the chairman of the commission representing the United States Government, and that it was unanimously adopted by the congress.

TESTING OF ROAD MATERIALS.

The testing of road materials to determine their suitability for road building has reached a high state of efficiency in this Department, and it is a cause for much gratification that the work which is being done by the road-material laboratory is regarded in England, and by many authorities in other European countries, as being further advanced and more effective than similar work done in any other government laboratory in the world. So highly is this work regarded by the chief highway officers in England that a request has been made to the Department to test some of the characteristic road-building materials of Great Britain.

In the borough of Hornsey, in England, it has been ascertained that a number of sections of exceptionally good roads have been constructed by the mixing of limestone and siliceous rocks in accordance with suggestions contained in publications of this Department setting forth the results of experiments in the mixing of these materials, whereby the cementing value is increased beyond that of either material alone, thus making possible the use of many crystalline rocks of low cementing value and of low cost.

OBJECT-LESSON ROADS.

Measured by comparison with previous years' results, the object-lesson work of the past year was the most successful in the history of the Department. At the close of the year 31 object-lesson and experimental roads had been completed, or were in course of construction, illustrating the best methods of road construction as adapted to conditions in each section of the United States. These object-lesson roads were instrumental in the giving of instruction in the art of road building, and it may therefore be said without exaggeration that the Department maintained 31 temporary schools in road building.

The engineers from the office made the necessary surveys and prepared the plans and estimates and supervised the construction, instructing the local road builders at each stage of the work. In all, 10 macadam, 6 sand-clay, 4 gravel, 3 earth, 3 burnt-clay, 1 shell, 2 tarred, and 2 oiled roads were constructed, making a total of 223,208 square yards of road surfaced. Object-lesson and experimental roads were constructed in Massachusetts, Virginia, West Virginia, South Carolina, Kentucky, Tennessee, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Wisconsin, Missouri, Arkansas, North Dakota, Nebraska, and California during the year.

UTILIZATION OF BY-PRODUCTS.

Approximately 20,000,000 tons of blast-furnace slag are produced annually in the United States, most of which is a total waste. Slag

has been used very slightly as a road-building material, for the reason that it is exceedingly difficult to maintain a well-bonded surface. The Office has, during the past year, inaugurated experiments in the building of roads of slag in combination with tar and asphalt preparations along original lines. It is hoped that these experiments will not only open the way for a more general use of slag as a road material, but that the addition of bituminous binders will result in much progress in the development of dustless roads.

Some interesting experiments which have not yet progressed to a point where definite results can be anticipated have had for their object the utilization of the by-product of the beet and cane sugar refineries which, at present, has very little commercial value. This by-product is a thick sirupy liquid which remains after the various grades of sugar and of molasses of commercial value and alcohol have been obtained.

ROAD CONSTRUCTION, ADMINISTRATION, AND MAINTENANCE IN FOREIGN COUNTRIES.

Early in the past summer a list of questions was prepared in this Office which the State Department transmitted with a letter of instructions to the American consuls in every foreign country. Copies of the replies are being forwarded to the Department of Agriculture by the State Department, and it is probable that within a comparatively short time complete and interesting data will be available for the American public concerning all phases of the road subject in every foreign country.

At the same time an investigation is being arranged through correspondents in each county in the United States whereby complete information concerning roads, road revenues, and expenditures for this country will soon be available.

CORROSION OF IRON AND STEEL.

This investigation was begun for the purpose of determining the cause of corrosion of metal road culverts, and to discover if possible the means of preventing or minimizing the corrosion. Investigation thus far has produced data of great scientific and practical value, which are set forth in publications issued by this Department. The results of the work have already proved of great benefit, as several of the rolling mills have materially modified their methods of manufacture to conform to the conditions indicated as essential in the results of the investigations.

During the past summer test fences were erected at Pittsburg and Atlantic City, and at the latter place a number of large plates of

steel were set up in frames facing the ocean. These plates were painted with standard pigments and with pigments prepared according to specifications drawn up in the Office of Public Roads. The purpose of this test is to determine the relative merit of the pigments used in the prevention of rust.

TRACTION TESTS.

At the close of the past fiscal year arrangements were made for conducting during the current year a series of thorough traction tests to determine the tractive resistance of various road surfaces and grades and various widths of tire. Much instructive and interesting information should result from them.

GENERAL ADVISORY WORK.

The demands upon the Department for expert advice on road construction and maintenance have grown continuously in recent years, both in volume and in complexity. The result has been that a corps of consulting highway engineers of the widest possible experience and adaptability has grown up in the Office of Public Roads, supplemented by specialists in the various methods of road construction and in the various lines of experiment.

Considering the year as a whole, it is within the bounds of conservatism to say that far greater results have been accomplished than in any preceding year, and that the status of road work in general throughout the United States is more advanced and more promising for future development than in any year since the settlement of North America by the white man.

REVIEW OF TWELVE YEARS.

In presenting an account of the work of the Department it may be worth while to survey the last twelve years of endeavors, and of their fruition and promise, to which not only this Department has contributed, but also the experiment stations, the agricultural schools and colleges, the State boards and commissioners, the agricultural press, and the farmers themselves in their individual and collective efforts.

Momentous changes have occurred to agriculture in this country during the last dozen years. Features of great import have been introduced. Forces have become operative whose results are already enormous, with the certainty of cumulative and accelerated future consequences for the Nation's good and well-being. The farmer's work and harvest have had the benefit of more varied knowledge and

more effective intelligence. His life and living have undergone transformations which increasingly make the farm preferable to the town.

IMPROVED FINANCIAL CONDITIONS.

This period has developed an amazing and unexampled prosperity for the farmer. His improving financial condition has been both an effect and a cause—an effect partly of his own efforts joined to those of public agencies, and also the means of making his life and the lives of his wife and children the better worth living.

More wealth has been invested in improving the farm home and in the current expense of farm life. With better houses filled with modern conveniences, the family life has developed in strength and in enjoyable living. Through the introduction of machinery, the betterment of buildings and appliances, and the improvement of methods the farmer's labor is rapidly becoming less in physical stress, and the burdens of the household are becoming lighter. Child life on the farm is entering upon a realm of favoring conditions in the home, at school, and in farming, and home-making apprenticeship is rising to a higher level.

CHANGE FROM LOW TO PROFITABLE PRICES.

The year 1897 or thereabouts marked the farmer's financial turning point. The prices of his products had previously often been below the cost of production, and he occupied a weak position as a seller. Within a very few years thereafter prices had risen so as to make him strong as a seller and to enable him to hold his crops for fair prices.

Corn was worth but 21.5 cents a bushel at the farm December 1, 1896, as an average for the United States, and less than that in the great corn States. By 1900 the price had risen to 35.7 cents, and the November price of this year is 63.5 cents.

Wheat sold for as little as the average of 49.1 cents a bushel December 1, 1894; a marked increase to 69.5 cents favored the crop of 1903, and now the November price is 91.5 cents.

The farmers and planters of the cotton States were in a wretched financial condition when the cotton crop of 1894 was sold for 4.6 cents a pound. Their independence began with the price of 11.66 cents in 1903. During the last six years the mean price of cotton to the growers has been 9.865 cents and the seed has brought them many millions of dollars annually.

Hay was worth at the farm only $6 a ton in 1898; the price rose to $10.01 in 1901, to $11.68 in 1907, and it was $9.22 on November 1 of this year. The farm price of oats was at the low figure of 18.7 cents a bushel in 1896; in 1901 it was 39.9 cents; in November, this year,

46.5 cents. Barley was sold for 32.3 cents in 1896, 45.9 cents in 1902, 66.6 cents in 1907, and 53.7 cents in November, 1908. Rye was at the low price of 40.9 cents a bushel in 1896; in 1901 the price was 55.7 cents; in November, 1908, 73.7 cents.

Tobacco was not worth raising at the average price of 6 cents a pound in 1896; there was some improvement with 8.1 cents in 1904; still more with 10.9 cents in 1907; and perhaps a higher price this year. In 1896 potatoes brought 26.6 cents a bushel to the farmer; the rise was to 76.7 cents in 1901 and to 69.2 cents in November, 1908.

In the meantime the prices of domestic animals had participated in the forward movement. Horses of all ages had the average value of only $31.51 at the farm January 1, 1897. The average was $52.86 in 1901 and $93.41 in 1908. From the low price of $41.66 per mule in 1897, all ages included, the figure rose to $63.97 in 1901 and to $107.76 in 1908.

The farm price of dairy cows has gone from $21.40 in 1892 to $27.45 in 1898, and to $30.67 in 1908; of all other cattle of all ages, from $14.06 in 1895 to $20.92 in 1898, and to $16.89 in 1908.

A remarkable change in price was in that of sheep, from $1.58 in 1895, all ages included, to $2.46 in 1898 and $3.88 in 1908. Hogs had the low price of $4.10 per head January 1, 1897; the average was $5 in 1900, $7.62 in 1907, and $6.05 in 1908.

The consequences of such rises of prices need not be itemized. The old cotton plantation that no lender wanted as a mortgage security is now sought for investment and its owner can borrow without mortgaging. The farmers of the mortgage-ridden Kansas of former days have stuffed the banks of that State full of money, have organized banks of their own, and have sent money to the East to invest.

AGRICULTURAL SCIENCE.

Relieved of the weight of debt and of suffering under unprofitable prices, the farmer felt more responsive than before to the help offered by the Department of Agriculture, the experiment stations, and other sources during the period under review. Thousands of learned investigators worked for him. Thousands more talked to him repeatedly. Thousands of demonstrations taught how to do by doing. Many boys were educated in agriculture. Hundreds of millions of copies of publications were sent broadcast. The story of what was done by Nation, State, and private persons can here be stated only briefly.

PLANT AND ANIMAL BREEDING.

Both the science of breeding plants and animals and practical methods have made remarkable advance. During the past dozen years breeding has passed the unorganized stage and has come under

the domain of science. Rapid advances are being made in the study of the laws under which heredity operates. The exceedingly great value of the rare mutating plant or animal which has the power to project its unusual individual values into its progeny and thus produce a valuable new strain has come to be appreciated as the most important source of creative breeding.

The public scientist and the cooperating groups of breeders and growers of pure-bred seeds, plants, and animals are organizing State breeding establishments, where large numbers of plants and animals can be brought under performance. The wheat breeder by working out methods of testing and recording breeding values has assisted the animal breeder.

DEFINITE RESULTS WITH PLANTS.

The breeding of types of Sea Island cotton immune to various diseases; the securing of types of nitrogen-gathering plants to use in rotation with such kinds of cotton; improvements of the fiber of other kinds of cotton and of its productivity; the marked increase in corn production due to knowledge of the laws governing corn breeding; the establishment of important tobacco industries, such as the growing of the Sumatra wrapper leaf and the Cuban filler through adaptation to proper conditions, and the creation of desired strains by breeding; the securing of a whole series of hardy citrus fruits; improvements in wheat and oats—these are some of the grand achievements of plant breeders. These words are few, but the millions of dollars created annually by reason of the work of these men are many.

In one State this Department and the experiment station jointly spend less than $20,000 annually in conducting a plant-breeding establishment, and half a dozen varieties of newly bred field crops have been distributed which added this year $2,000,000 to the value of the same crops as raised in former years, because of their improved heredity.

Hybridization and seed selection in the case of existing crops have been performed scientifically to produce varieties to meet new conditions, to produce larger yields, to resist cold, drought, and disease. With the advent of the cotton boll weevil, the breeding of cottons fitted to escape weevil injury, to produce longer staple and heavier yields, and to resist wilt, root rot, and other diseases, was undertaken with gratifying results. Several entirely new cotton hybrids have been developed which possess great improvement over former varieties. This Department's newly bred, heavy-yielding, long-staple Upland cotton, the Columbia, received a gold medal at the Jamestown Exposition.

The wilt-infested cotton soils of the Southeast have been outwitted by the breeder of wilt-resistant varieties of both Sea Island and

Upland cotton. The breeder has hastened the maturing of cotton to insure the safety of the crop upon the arrival of the boll weevil. Varieties of Guatemala cottons have been introduced and acclimatized because they have characteristics that enable them to resist the boll weevil. Egyptian cotton has been introduced, acclimatized, and established in the Colorado Valley in Arizona and California.

Good progress has been made in breeding single-germ seed balls, which will greatly reduce the labor and cost of growing sugar beets. High-grade sugar-beet seed, fully equal to the best imported, has been bred in this country.

Among the results of breeding tobacco for quality, uniformity, and yield are the Uncle Sam Sumatra, the Hazlewood Cuban, the Brewer Hybrid, and several other improved types which have been disseminated and which give an increased yield of 50 to 75 per cent of great uniformity and high quality.

Corn-breeding methods have developed varieties whose yield is 15 to 25 per cent above that secured by the best of the former varieties. This Department has introduced from Guatemala for breeding purposes new types of corn adapted for growth in the moist Gulf regions and other varieties for growth in the hot arid regions. The development of quick-maturing, high-yielding dent corn for the northern edge of the corn belt has been accomplished by the experts of the Department.

The corn plant is very pliable in the hands of skillful breeders. Ten generations of breeding at the Illinois station have increased the average protein content from 10.92 per cent to 14.26 per cent, and also have decreased it to 8.64 per cent; the average oil content has been increased from 4.70 per cent to 7.37 per cent and diminished to 2.66 per cent.

Seed-corn breeders' associations now exist in most of the States of the corn belt. Seed corn is now largely grown as a special crop. Pure strains are being developed, new varieties originated, and older ones improved.

The Florida sweet orange has been hybridized with the cold-resistant trifoliate orange and several new strains with greatly increased hardiness have been developed, so that the orange-producing area has been much enlarged. From these hybrids it is expected that citrus fruits of great value will eventually be grown throughout the Southern States.

At the Colorado Experiment Station a cantaloupe has been bred that is resistant to the rust fungus. In South Dakota the third generation of seedlings of the native sand cherry produce fruits 1 inch in diameter and of good quality. Native Dakota plums and sand cherries have been hybridized with other stone fruits from Europe and Asia to combine the hardiness of the native fruits with

the size and quality, to some extent at least, of the choice cultivated fruits from abroad. In New Jersey practically all of the important vegetables have been subjected to hybridizing and breeding, and many new varieties with desirable qualities have been produced and disseminated.

Good varieties of wheat have been originated by breeding. The Minnesota station originated numerous varieties, two of which have spread over half a million acres, and yield from 1 to 3 bushels more per acre than the varieties formerly grown. The Maryland and Michigan stations bred new varieties of wheat, which are now grown in those States. The winter-wheat belt has been extended farther and farther north by sowing adapted varieties until it is now grown in regions which had before been regarded as incapable of growing it. Winter character has been added to the spring wheats of the Pacific coast and new hybrids of these wheats are now grown there.

Methods of growing winter oats successfully in Southern States have been developed of late by some of the southern experiment stations and varieties of oats adapted to winter culture have been distributed. The Wisconsin station improved the Swedish Select oats and 5,000,000 bushels of this variety are now grown by Wisconsin farmers.

The Minnesota station originated and disseminated a promising variety of flax for seed production, and the North Dakota station achieved great success in combating the wilt disease of flax by treating the seed and by developing resistant strains.

NEW STRAINS OF FARM ANIMALS.

The Department has begun experiments to ascertain the effects of close breeding. Cooperation of the Department with State stations and farmers has begun to create new strains of farm animals—carriage horses, in Colorado; cattle for beef production under southern conditions, in Alabama; the cross of the horse and the zebra, in Maryland; the reestablishment of the Morgan breed of horses, in Vermont; sheep especially suited to range conditions, in Wyoming; a breed of milking Shorthorn cattle, in Minnesota; draft horses, in Iowa; improved Holstein cattle, in North Dakota; a breed of hens for high egg production, in Maine.

INTRODUCTIONS.

Trained explorers are constantly traversing foreign and remote lands in search of promising seeds and plants for trial and possible introduction into the United States, and from this one feature of the Department's work many millions of dollars are added yearly to our national production of wealth.

DURUM WHEAT, RICE, AND BEETS.

From Russia and Africa durum wheat was brought during 1899 to 1902, and thus was laid the foundation of the great crop of this special kind of wheat in this country, which amounted to 45,000,000 bushels in 1907, worth $30,000,000 to the farmers, and providing exports of 22,000,000 bushels. The rice growers of the Gulf coast received superior varieties from the Orient, which have greatly increased the value of the American rice crop and given to it a firmer basis.

Sugar-beet growing for producing sugar had hardly become established in 1897, and the production of that year was only 45,246 short tons of sugar. Since that time this crop has been introduced into new parts of the sugar-beet belt, with the result that the crop of this year amounts to nearly 500,000 tons of sugar, worth $45,000,000.

ALFALFA AND WINTER WHEAT.

So immense has become the production of alfalfa, an introduced plant, that attempts to estimate its quantity and value fail. It is supposed that this year's alfalfa hay is worth $100,000,000. This is the great forage plant and soil renovator of a vast area in the Rocky Mountain and Pacific coast regions. Its growth is extending eastward, and it has become generally established as far east as the longitude of eastern Kansas, and it is partly or fully established in spots throughout the North Central States, in the limestone regions of Kentucky and Tennessee, and in a less degree in the North Atlantic States. Several cold and drought-resistant strains of alfalfa have been introduced, including an oasis alfalfa from the Sahara, resistant to alkali; various types of Turkestan alfalfa, resistant to drought; Siberian alfalfa, resistant to cold; the sand lucern, a north European variety, very resistant to cold; Arabian alfalfa, resistant to drought; Peruvian and Chilean alfalfas, suitable for culture in the Southwest.

New varieties of hard winter wheat have been introduced which have been mostly instrumental in extending the winter-wheat districts over 200 miles farther north and west, and which give an average yield of 5 bushels per acre more than the spring sorts.

CONTINUED ADDITIONS.

The Swedish Select, the Tobsk, and the Sixty-day oats have been introduced and have proved of far greater value than former local varieties in the North and Northwest.

A variety of soy bean has been introduced from central China, suitable for becoming a cover crop for rice lands and greatly needed by the rice growers of the Southern States.

The best varieties of the date palm, the offspring of the oasis of the Algerian Sahara, have been introduced and established in the Southwest. The dry-land olive has been successfully introduced into Arizona and southern California.

The value of the prickly pear as a forage plant has been demonstrated, and this plant is now grown under cultivation and bids fair to render agriculture practical in regions where the rainfall is too intermittent to permit the growing of ordinary crops.

The discovery of a simple method of extracting camphor from twigs and leaves and the demonstration that American-grown trees contain a high grade of camphor have enabled this Department to begin the establishment of a camphor-growing industry in Florida.

The basic thought underlying plant introduction has been home production in place of importations, the production of wealth and the diversification of products within the Nation in place of dependence upon foreign agriculture.

FARM MANAGEMENT.

The State experiment stations, the colleges of agriculture, and the Department are placing the subjetc of managing the farm on a scientific engineering basis. The planning of a new farm or recasting the field plan of the old farm are being reduced to such form that they are profitably taught in agricultural schools. A number of the experiment stations have determined the kinds of crop rotations which yield the largest net returns for given soils and agricultural districts. Numerous long-time experiments on State and branch experiment station farms controlled by the Department are under way to determine those crop rotations and other methods of internal management of the farm which will be most profitable and best adapted to the family and other available labor.

In cooperation with the Minnesota Experiment Station a method has been developed of securing under average actual farm conditions the cost of each farm operation and of each crop, animal, or other product. By using these figures of cost per acre and per unit of product, and of the crop or other resulting product, a system of simplified farm accounting and cost keeping has been devised. The most novel part of this system of teaching farm management is farm maps, which serve in such a simple and convenient manner as an annual ledger of crop production cost and net income that farmers can easily use it.

Extensive studies are made of the best practices of successful farmers in all parts of the country. Demonstration of the wisdom of doing things in prescribed ways by calling attention to desirable results; plans of farm management that raise the income per acre from a paltry sum to a very profitable one; instruction in farm practices in hundreds of particulars, the success of which is readily understood in terms of profitable income—these are lines of work which have been followed and have produced widespread diffusion of agricultural knowledge and improvement.

DEMONSTRATION WORK.

The boll-weevil territory affords a notable example. In 1904 the Department inaugurated on a small scale what is now known as its "Farmers' Cooperative Demonstration Work." The initial efforts met with such emphatic success that the work has been gradually increased until now the whole cotton belt and many outlying regions are covered by a large force of trained field agents, all practical farmers. These men are wielding a wonderful influence among the farmers of the South to adopt better cultural methods, to use improved seed, and thus to increase their profits.

Striking proof of the success of this work is that the results have attracted so much attention that voluntary private contributions toward its extension have almost reached the total amount appropriated by Congress for its maintenance. Large districts which had been almost deserted on acount of the boll weevil are now more prosperous than at any time in their history, and many men who have been renters are buying land and raising cotton profitably as a result of better systems of management.

Closely related to this work are the farm management investigations of the Department, consisting primarily of a detailed study of the practices followed on the most successful farms in well-defined communities, and the application or adaptation of these practices to other and less prosperous farms throughout the country. The aim in all this work is to bring the farm up to its maximum producing power through systematic management, both as to culture practices and as to business methods.

Along this line of work important progress has been made in aiding the farmer to put into practice results of scientific discovery. Methods of storing the soil with humus without interfering with established cropping systems have been taught, especially to the farmers of the cotton States, who keep comparatively little live stock. The production of hay in the South has increased greatly where this work has reached. Improved crop rotations have been devised and put into practice. The principles involved in planning cropping systems on live-stock farms have been applied. Studies of weeds have resulted in discoveries that enable the farmer to destroy such serious pests as Johnson grass and quack grass at comparatively little expense.

A practice highly important to the corn crop, that of shallow cultivation, has become prevalent in the corn belt and is growing in favor elsewhere; this counts for increased yield. In wheat culture, early plowing and thorough preparation of the seed bed are much more extensively practiced than formerly.

DRY FARMING.

Dry farming has come to be recognized as an important factor in our future agricultural progress. Much useful information has been accumulated to determine the conditions under which crops may be successfully grown, the best systems of crop rotation, and the tillage required for the conservation of soil moisture to adapt new crops to the dry regions. It seems probable that as a part of this work and of the reclamation projects, a half billion acres of dry and arid land will be made available for agriculture in the course of time. The last ten years have witnessed a remarkable exodus of people from the eastern parts of the country to the western, especially to the dry part of the Great Plains. This vast region, formerly considered of little use for cultivation, is rapidly becoming one of considerable agricultural importance under the guidance of the Department and State experiment stations.

SOILS AND THEIR TREATMENT.

Soil surveying was begun by this Department nine years ago. The reason for this work is the fact that each variety or strain of crop produces its best in some certain soil and climate, and that for each soil and climatic condition there are crop rotation and farm-management schemes which pay best. The object of the survey, therefore, has been to find the proper soil for the crop, the proper crop for the soil, and to aid in devising scientific engineering plans for the management of farms on each class of soil and in each agricultural region. The survey has now covered 150,000 square miles in all parts of the United States, a larger area than the total land area of Great Britain and Ireland, or of Japan. It has led to the growing of special types of tobacco in the Gulf States, it has made marked progress in the standardization of soil descriptions, and it has brought close cooperation between the National Government and various States.

In the course of this survey the alkali problem has been solved. The rise of alkali to the surface had caused the abandonment of wide areas of land in the belief that when once it has appeared no further use can be made of such lands. The Department has demonstrated in widely separated districts in the arid West that the reclamation of areas unproductive on account of the presence of alkali is both feasible and economical.

Much attention has been given to the study of soil bacteriology, and improved strains of nitrogen-fixing bacteria have been developed and widely disseminated and have proved highly useful in the inoculation of the various leguminous crops to increase their accumulation of nitrogen.

Instruction in the conservation of the soil and its fertility by all available means has been incessantly carried on by the Department, the experiment stations, agricultural colleges, and by private publications. The importance of the cover crop to prevent winter erosion and to hold the humus and fertile elements of the soil for the benefit of succeeding crops has been one of the most emphatic teachings and has been prominent in every plan of crop rotation and farm management. The utilization of leguminous plants for enriching the soil, such as alfalfa, clover, and cowpeas, has been much extended throughout the country. So great has been the demand for cowpea, velvet bean, and crimson clover seed in the South that the farmers have been unable during the last two years to secure a sufficient quantity, even at very high prices.

VEGETABLE PATHOLOGY.

Plant diseases have been suppressed and avoided during the period under review in a far greater degree than ever before. A true science of plant pathology has been founded and the discovery of the causes and treatment of diseases has led to many improvements in mechanical methods of utilizing fungicides. Still greater advances have been made in the direction of plant sanitation, and improvements in the environment of plants as well as in the plants themselves have increased production, both in quantity and in quality. No part of the work of the Department and the experiment stations yields a more direct cash return than this.

OVERCOMING AND AVOIDING PLANT DISEASES.

A method of spraying trees has been devised which effectively prevents the bitter rot of apples, a disease which has caused in one year a loss of over $10,000,000.

A simple and effective method of preventing peach-leaf curl has been discovered which already saves hundreds of thousands of dollars annually. The peach-twig blight or gum disease of the peach, in California, is a disease which caused great loss of peaches in that State, but a method for its control has been discovered. The nature and method of control of the disease known as "little peach," which has threatened to destroy the peach industry of Michigan and western New York, has been determined. A method of controlling the pear blight, a disease which has destroyed the best varieties of pears in many parts of the country, including $5,000,000 worth of orchards in California, has become effective.

A new spray—self-boiled lime-sulphur—has been discovered which may be safely used in spraying peaches for the control of the brown rot, a disease which has destroyed annually from 15 to 30 per cent of the peach crop. This mixture is also a valuable general spray, as an insecticide, and is effective in the treatment of San José scale.

Among numerous discoveries are the causes and the methods of control of the brown rot of cabbage, turnip, potato, tomato, and egg plant, and of numerous other bacterial diseases of crops; the wither-tip and orange blight of citrus fruits, two diseases which have caused great loss; and the cranberry scald and rot, causes of heavy losses. The cause of wilt disease of watermelon and cowpea has been determined and the disease has been avoided by the introduction and development of resistant varieties of these crops where old varieties will not grow.

Investigation of the causes of decay of timbers and the methods of preventing it has resulted in improved methods of handling timbers and in impregnating them with protective substances. A cheap and effective method has been discovered for treating fence posts to prevent decay.

INSECT PESTS.

Most civilized nations have quarantine regulations to exclude insect pests, and the United States is the only exception of prominence, but in this country the subject of remedies against this class of insects has received the greatest attention. The perfection of the lime-sulphur-salt wash has practically solved the San José scale problem, and recent investigations by the Department as to the use of hydrocyanic-acid gas against scale insects on citrus trees have been so successful as to promise the saving of a large number of orchards of great value.

PREVENTION OF DAMAGE.

The discovery of the original home of the San José scale in China by a learned expert of the Department and the introduction of its natural enemy into this country was an achievement of note, but the economical use of sprays has rendered the attempted establishment of the natural enemy a matter of comparatively slight importance. The tremendous effect of the spread of the San José scale was beginning to be realized twelve years ago, but in the meantime the efforts of this Department and of the experiment stations have enabled fruit growers to save their trees from this insect.

Much has been done in practically utilizing the natural enemies of injurious insects and in introducing into the United States beneficial insects of one kind or another. This Department has introduced into California the fig-caprifying insect, which has established a strong Smyrna-fig growing and packing industry. Parasites of the gipsy moth and of the brown-tail moth have been introduced which bid fair to relieve New England from the present danger to orchards and forests, and the rest of the United States from prospective danger.

Hawaii has introduced natural enemies of the sugar-cane leaf-hopper, which have relieved the sugar-cane crop of that territory

from an immense burden. Successful experiments for handling the parasites of the Hessian fly promise to be of great value to the wheat farmer. An egg parasite of the imported elm leaf-beetle has been brought from Europe.

Within the period under review studies of the cattle tick and its allies have resulted in developing a system of cultural rotation which enables cattlemen in tick-infested localities to rid their land of ticks by a simple and effective process, and a movement under Federal auspices promises to result in the eradication of this insect.

Great discoveries of enormous value to the health of the people have been made in investigations carried on concerning the life history of malaria and yellow fever mosquitoes and of the typhoid fly, and concerning the causes of the widespread hook-worm disease and remedies therefor. Measures founded upon these discoveries can readily be taken, and this will result in freeing large regions from some diseases.

In work concerning injurious insects, the United States has been a leader among nations. Other countries have appealed to this one for assistance and advice, as well as for men to carry on similar work.

USEFUL BIRDS.

Systematic observations have been made to identify the injurious and useful birds and wild animals. In a general way it is true that most of the birds are more beneficial to agriculture than otherwise. An increasing understanding of this fact has undoubtedly checked the ruthless destruction of nongame birds and is now promoting their preservation. Some of these birds are of very large economic value to the farmer. The services of the native sparrows in destroying weed seeds have been valued at many millions of dollars annually. Were it not for woodpeckers and other insect-eating birds there would be forest destruction. Caterpillars which destroy the foliage of fruit and shade trees are the food of birds. The scale insects that infest fruit trees are eaten by no fewer than 57 species of birds. The execution of the Lacey law for the protection of game is under the administration of this Department and the interstate transportation of game in violation of law has practically ceased.

VARIOUS DISCOVERIES AND IMPROVEMENTS.

Millions of dollars have been saved to the handlers of tobacco leaf by the Department's discovery of a fermenting process for curing cigar tobacco.

A simple, cheap, and effective method of destroying the harmful bacteria and the algæ in water has been discovered and its usefulness widely demonstrated.

The important discovery was made that the loco disease of range stock was due to a metallic poison absorbed by certain leguminous

plants eaten by stock on the range, and this discovery has indicated methods of control.

Laws have been enacted to protect the farmer against fraud in the purchase of fertilizers, foods, feeding stuffs, seeds, disease and insect infested plants.

Increased and wider knowledge of the nutritive value of food and of the better utilization of agricultural products as human food has followed the nutrition investigations of this Department, in cooperation with the experiment stations and other State institutions. Animal nutrition investigations, begun in cooperation with the Pennsylvania experiment station, are accumulating most accurate and scientific information, developed by use of the respiration calorimeter, an instrument invented by experts of this Department.

The Babcock test, invented at the Wisconsin experiment station, a simple method for determining the percentage of butter fat in milk, has entered more widely into use on the farm during the period under review, and a curd test has been invented for ascertaining the percentage of casein in milk, a matter of great importance to cheese factories.

Experiment stations have been established in Alaska, Hawaii, Porto Rico, and Guam, under the supervision of the Department. There is wider and more intelligent use of fertilizers, both farm-made and commercial.

Experiments conducted by scientific men in the feeding of farm animals to determine the relationship between feeds of different kinds and quantities on one hand, and gain in live weight in growing and mature animals on the other, have resulted in highly important discoveries which enable the farmer to feed with economy and to produce maximum results. One result of this new information is the marketing of meat animals at earlier ages than formerly, for which they are prepared by a forcing of growth. When approaching maturity of growth, the animal gains in weight at a greater and greater cost per pound of gain, and the fattening of a mature animal is a relatively expensive proceeding. Farmers have availed themselves of this knowledge generally throughout the principal live-stock States.

MARKETING PLANT PRODUCTS.

Marked improvements in methods of preparing, shipping, storing, and otherwise caring for the products of the soil have resulted from the practical field experiments of the Department and the stations. This work covers the storage of commercial seeds; the handling, transportation, and standardization of grain; and the handling and baling of cotton.

Perhaps the widest popular interest has been in the work of improved methods of caring for perishable products, chiefly fruits.

The Department has examined the practices followed in the California citrus groves, in the warehouses, and in other features of the citrus industry of that State. In consequence of this, the Department has induced the growers and warehousemen to adopt improvements which are probably saving to their industry more than a quarter of a million dollars annually. These improvements include the picking of the fruit, methods of packing, loading on cars, pre-cooling, and, indeed, the whole process from tree to market. The conditions of transcontinental shipment have been improved and attention is now given to trans-Atlantic exportation. This work has been extended to the Florida citrus industry and the deciduous fruit industries of New York, Iowa, and other States.

Markets for perishable fruits, such as peaches and pears, have been opened in foreign countries, and, through improved methods of storing and handling, these fruits have been kept free from decay when shipped long distances. Improved methods of harvesting, storing, and handling apples have led to remarkable changes in the selling of the crop.

Great advance has been made in improving the methods of exporting and grading grain. An apparatus has been developed and introduced for quickly determining the moisture content of grain which has placed this feature of the inspection work on a satisfactory basis.

ANIMAL INDUSTRY.

The dairy cow maintains an industry whose products are worth more than the wheat crop or the hay crop or "King Cotton." They go to almost every one of the 19,000,000 families of the country as milk or butter or cheese, but more especially as milk. It is a matter of greater concern to the public than ever before that milk and butter should be wholesome and unadulterated. The quality and healthfulness of these products largely depend on bacteria. It has been necessary to educate the dairyman and the public in the exclusion of injurious bacteria and in the use of beneficial bacteria of such kinds as impart the desired flavors to butter and cheese. Such education has been immensely promoted by the work of the Department and of the experiment stations during the period under review.

IMPROVEMENTS OF THE DAIRY INDUSTRY.

This Department has organized and perfected a system of inspection of dairies and milk-distributing plants which within two years has been adopted by over 140 of the larger cities. It has great value in giving to dairies a definite rating on the basis of a score card in which 100 points are perfect, and the application of this inspection is distinctly educational. Definite things are pointed out where improvement can be made, and the system has been received with great favor by the authorities in charge of dairy inspection.

Under a special appropriation by Congress a systematic effort, in cooperation with State authorities, has been made to introduce dairying into the South where it has not existed before. It has been demonstrated beyond doubt that dairying can be carried on profitably in the South, and not only have southern farmers been enthusiastically engaged in the work, but some of the States have made appropriations for its extension.

Supplementary to the inspection of creameries performed by State dairy officers, this Department has initiated a system of market inspection of butter followed by reports back to the creameries in which it is made, the object being to provide the butter maker with information concerning defects. Through the efforts of the Department there has been a general awakening on the part of creamery owners and managers to the immense loss annually sustained by reason of incompetent business management, and the publicity given to this work has caused three great dairy schools to offer this winter for the first time special courses in creamery management.

The educational work of the past twelve years in behalf of improved dairy conditions has caused, through private means, the organization of a national dairy show association, which holds an annual show in Chicago. It brings together everything in dairying from the breeding and feeding of dairy stock to the finished dairy products in the form of butter, cheese, and milk. It is the center of a great annual gathering of dairymen in the broadest sense of that term and is becoming a great factor in dairy education and advancement.

Experiments by this Department within a few years have practically demonstrated that butter manufactured from sweet pasteurized cream without fermentation of any kind has keeping qualities greatly superior to butter made from ripened cream, as in the prevalent practice. The introduction of this system will mean the saving of cost in manufacture. Distinct progress has been made in determining the causes of the undesirable flavors in butter and in suggesting means for preventing their development.

The percentage of moisture in butter has become of some importance for the reason that it is possible to load butter with water without detection by the consumer. Various devices have been contrived for determining the percentage of moisture, and some of these enable butter makers to prevent the percentage of water from exceeding the limit prescribed by law.

Butter making in the home dairy and creamery has been almost revolutionized by the introduction of the farm separator, which separates cream from milk by a centrifugal process. The shallow pan or crock system and the deep-setting system have been largely eliminated, and with their exit a considerable part of the drudgery of the household disappeared. The farmer is now no longer required

to make the daily trip to the creamery; he can retain the skim milk to feed his calves and pigs and deliver the cream, sweet, every other day, when properly cared for, and this substitution of cream delivery for milk delivery by creamery patrons saves them labor and millions of dollars yearly in expense.

Dairy education at our agricultural colleges has proved most effective. Short "trade dairy school" courses have been provided for those already experienced in the work of cooperative and proprietary creameries and cheese factories. By such means American butter and cheese have been revolutionized in quality and uniformity and greatly increased in quantity and at the same time in the prices they command. Home dairying, as taught in agricultural schools, is also having a marked influence on the amount and quality of dairy products produced and on the profits from dairy farming.

MEAT INSPECTION.

Meat inspection under the National law has extended from a few of the larger packing establishments doing an export business in the largest cities twelve years ago to all the establishments of the country conducting an interstate or export trade in meat and meat food products. The scope of the work has been enlarged to include the supervision of the handling and the preparation of all meat food products and the sanitary conditions under which they are produced, as well as the thorough inspection of the animals for disease before slaughter and at the time of slaughter. Inspection is now maintained at about 800 official establishments; market inspection is maintained in 35 cities; certificates of exemption from market inspection are held by 1,992 retail butchers and retail dealers. During the year ending June 30, 1908, 54,059,901 cattle, sheep, swine, and goats had ante-mortem inspection; 53,973,337 of the same sort of animals had post-mortem inspection, and the meat and food products inspected weighed 5,958,298,364 pounds.

DISEASES AND THEIR REMEDIES.

Important discoveries worth many millions of dollars to the farmers of the country have been made concerning the causes of and cures for animal diseases. The cause of hog cholera having been discovered, a cholera serum was prepared, and its use has demonstrated that it is a practical, trustworthy, and cheap preventive of this disease.

Methods of quarantine control of hog cholera have been worked out in some States and, with a preventive in the form of a serum, there is rising the hope that this disease, which causes millions of dollars of loss annually, may be eradicated.

After several years of experiments it was discovered by the Department that human tubercle bacilli were capable of producing

tuberculosis in cattle, and that tubercle bacilli isolated from cases of tuberculosis in children possessed all the characteristics of tubercle bacilli of bovine origin, thus pointing strongly to the danger of human infection from bovine sources.

Great progress has been made in devising methods of freeing herds of cattle from tuberculosis. Some States have induced all breeders of pure-bred cattle so to handle their herds as to be able to sell only tuberculosis-free breeding animals.

In 1896, 35,000 doses of tuberculin and 1,200 doses of mallein were distributed free of charge to officers of health throughout the country for testing dairy cattle for tuberculosis and horses for glanders. In the year ending June 30, 1908, 213,000 doses of tuberculin and 52,000 doses of mallein were distributed. Thus it appears that the efforts of the Department to assist health officers and farmers in the reduction of bovine tuberculosis are bearing fruit. Since 1901 all imported cattle have been subjected to the tuberculin test.

In 1896 a satisfactory vaccine for the prevention of blackleg in cattle having been discovered, its manufacture and free distribution to the cattle raisers of the United States were begun. The use of this vaccine has constantly increased, and during the past fiscal year 1,154,100 doses were prepared and sent out.

Owing to the rapid extension of sheep scab over the ranges of the West, it was deemed advisable in 1900 to begin active measures for its restriction and eradication. This work has been continued subsequently and now several States have been entirely freed from this disease. In 1903 similar work was undertaken against scabies in cattle and considerable headway has been made toward the eradication of that disease.

A method was perfected in 1903 for the rapid diagnosis of rabies, which consists of microscopic examination of the central nervous system where the presence of minute animal cells, known as Negri bodies, indicates the disease.

The losses from milk fever in dairy cows formerly reached a high figure, since only the more valuable cows in the herd are affected. In 1904 it became known that the injection of sterilized atmospheric air into the udder of the affected animal almost invariably resulted in a cure, and this method of treatment has been widely adopted through the efforts of this Department.

Texas fever has long been a cause of serious losses to the cattle industry of the South. After the discovery that many sections of that region were but lightly infested with the cattle tick which causes Texas fever, a movement was started in 1906 for freeing such sections of this insect, with complete success within an area of 64,000 square miles.

A strict quarantine system protects our live stock against the dangerous infectious diseases which prevail in other parts of the

world, so far as they are liable to be introduced by imported live animals; and when on rare occasions some malady, such as foot-and-mouth disease, gains entrance into the United States in some other way, it is promptly eradicated.

The foregoing are some of the principal achievements to preserve and make profitable the domestic animals of the farm, which are worth $4,500,000,000; these achievements and the breeding work previously mentioned, as far as they relate to meat animals, have been devoted to sustain a capital of $10,500,000,000 invested in meat animals and live-stock farms and ranges.

CROP REPORTING.

From the moment when the planting and sowing of the seed have begun, popular interest in the prospective quantity of the crop production continues until the harvest; and the interest in cotton, wheat, corn, and some other crops is world-wide. To provide information concerning the condition of growing crops, the amount of the harvest, the number of farm animals, and other statistical details at the earliest date and in such a way that it may be given to everybody at practically the same time, and not be available to even one person in advance, the Department's crop-reporting system has been recognized and safeguarded beyond peradventure of premature use of its reports.

Statements upon which these are mostly based are kept under seal and lock and key until they are considered, and the persons who handle them on the days when reports are issued are in confinement until these reports have gone by telegraph to every part of the country. Instead of being prepared by one person, as formerly, the reports are constructed by a corps of five persons, no one of whom can foresee what they will be in any particular.

The crop-reporting work has been much improved in other respects, one of the most important of which is the establishment and development of a service of traveling field agents, with three branches. One is a general service in which each man devotes all his time to travel and inquiry; another is a partial service of personal inspection performed by a man in each State, who also has a corps of correspondents, and a third is a special service for selected crops in which the field agents travel and devote their attention to their specialties.

So great have been the improvements of the crop-reporting service and so well is it protected against abuse that it never before stood so high in public estimation as it now does.

AGRICULTURAL CHEMISTRY.

At the beginning of the period under review the work of the Department in agricultural chemistry was confined to an analysis of soils, fertilizers, dairy products and cereals, and to sugar-beet investigations; at the close of the period there is not an industry nor

an activity bearing upon the welfare of the farmer that is not studied chemically, whether he be considered as producer or consumer.

Only a few of the particulars can be mentioned and these briefly. The manufacture of sirup from cane sugar has been studied, including the fertilization of the plant, improved methods of manufacture, and the chemical control of the factory operations with a view to producing a profitable merchantable product. In connection with this the suppression of sophisticated products and the proper labeling of substitutes are seen to be of very great agricultural importance in fostering the production of ligitimate sirup.

Environment studies based on the chemical examination of products grown in different parts of the United States under close supervision have afforded valuable information as to the effect of variations in temperature and rainfall on the sugar content of beets and Indian corn and the protein content of wheat.

A chemical study of the composition and effects of insecticides and fungicides, the establishment of the futility or even harmfulness of some of them, and of the loss to the farmer resulting from false claims made on the labels of such products, have led to a movement for National legislation on this subject, many of the States having already enacted laws governing the sale of such products.

The problems of soil analysis and fertilization have been attacked along the most painstaking and conservative lines, involving extensive pot experiments and the comparison of various methods of soil and plant analysis to determine the specific fertilizing needs of a given soil for a stated crop. The simple consideration of the determination of potash, nitrogen, and phosphoric acid in the soil has given way to the most complex studies of all soil constituents, both organized and unorganized.

Microchemistry and bacteriological chemistry have come to the aid of the soil and the food chemist especially and play a conspicuous part in solving the problems and meeting the emergencies which confront the practical chemist of to-day. Physiological chemistry has become an essential factor in the work, especially in the determination of injuriousness of preservatives or coloring matters added to foods and the specific action of certain drug products.

DENATURED ALCOHOL.

An important piece of legislation, in which chemistry has played and must continue to play a conspicuous part, is the denatured-alcohol act, for only by opening up possibilities for the utilization of agricultural wastes in its production and ultimately furnishing to the farmer a convenient source of light, heat, and motive power, and to the trade a cheaper industrial alcohol, can the object of the law be fully attained.

BENEFITS OF CHEMISTRY TO THE FARMER.

The economic trend of much of the work in agricultural chemistry is further illustrated by the studies made to prevent the injury to forests, crops, and stock by wastes from smelters and factories, while at the same time the manufacturer may learn from the chemist, in many cases, to convert a waste, previously a menace, into an additional source of profit.

While the chemistry of the sugar beet twelve years ago was largely concerned with the problems of its introduction, the chemistry of to-day has to consider the improvement and extension of a successful industry, in the production of a beet of high sugar content, in solving the problems which arise in manufacturing the sugar therefrom, and in converting the wastes into merchantable products, the latter being successfully effected in several ways. Here, as in the canning industries, the production of tannins, the making of paper, and the production of turpentines, the part played by chemical research in improving processes, introducing new materials, and conserving resources reacts to the benefit of the farmer, not only in increasing the market for his produce, but by enabling him to improve the character of his crop and insuring the return to him of a better manufactured product. An investigation apparently so far removed from immediate interest to the farmer as the extensive paint and varnish investigations now making is found to concern him in the production of flaxseed for the manufacture of linseed oil.

The great agricultural interests of the country have had no more efficient and unflagging servants than the official chemists, both in Federal and State employ, who have labored in their behalf. As an index to the growth of this service it may be noted that the Association of Official Agricultural Chemists, which in 1897 mustered some 58 members with 9 referees, considering soil and fertilizer analysis, dairy products, fermented beverages, sugar, tannin, and feeding stuffs, in 1908 had 200 chemists assembled in convention who were concerned in the official control of foods and fertilizers, whose standards and methods are quoted in the courts, in administering the laws, and whose referees and associate referees, conducting work on every phase of food and agricultural chemistry, numbered about 50—nearly as many as the entire attendance at the meeting held twelve years ago.

PURE FOOD AND DRUGS.

Throughout this period the researches of chemistry into the composition of foods and their sophistication, and the publication of these results, have been slowly creating the public opinion which resulted in the passage of the food and drugs act of June 30, 1906. Back of this result lies a mass of laborious detailed work and scien-

tific research necessary to differentiate between pure and impure products, to establish standards, to prove to the manufacturer the practicability of maintaining such standards, and insure their maintenance in the courts. Should this seem a far cry from the progress of agricultural chemistry, it must be remembered that the repression of sophistication means the increased demand for the best and purest products, besides the protection of the public health.

The report of the Chemist for 1897 contained plans for work on infants' and invalids' foods and the study of cereals and milling products; the report for 1908 contains the account of the first year's work under the pure food and drugs act, with a fully organized corps of 40 inspectors at work in the field, 21 inspection laboratories scattered through the country, and behind these, as they were behind the first movement toward the law, scores of specially trained chemists and bacteriologists, performing not only the mass of routine chemical work necessary to inspection, but conducting researches into every phase of food and drug chemistry necessary to the just enforcement of the law. The public health ranks very high in the welfare of the Nation, and without the progress which has been made in agricultural chemistry, though it be detailed and not capable of description under specific discoveries, the need of the food law would hardly have been discovered and the public opinion necessary for its passage could not have been aroused, nor could its provisions have been executed after its passage.

That foods should be wholesome and what they are represented to be is insured by chemical inspection and examination; that drug products of known quality should be available for the use of the physician, and that injurious or, at best, worthless preparations should not be foisted upon the people without their knowledge, are among the services rendered to the community by agricultural chemistry in the broad sense in which the enlightened policy of the past decade has interpreted it.

ROAD IMPROVEMENT.

The United States has now entered upon a great era of road improvement. The State aid and State supervision plan, beginning with New Jersey in 1891, has been adopted in principle by about twenty States, resulting in large appropriations from State funds, skilled supervision by competent highway engineers, and in many cases the utilization of State prisoners for road work. In many States individual counties are accomplishing by large bond issues and practical management results as satisfactory as are accomplished by State aid.

The demand for men specially qualified in highway engineering is increasing at a rapid rate, and for this reason the Department has

cooperated with educational institutions and urged the establishment of courses in highway engineering, or a modification of civil engineering courses, so as to provide the necessary instruction. Many colleges and universities are making definite progress along these lines. In connection with this movement, the Department has for several years appointed annually a small number of graduates in civil engineering and given to them thorough and practical training in highway work for one year. A number of these young engineers have passed from the Department's service to important situations in State and county road work.

MATERIALS AND CONSTRUCTION.

In many parts of the country almost devoid of road-building rocks, the cost of macadam roads is prohibitive. Experiments have demonstrated that the sand-clay method of road construction is a fairly good substitute for macadam road, and roads so built are giving satisfaction in various Southern States.

Burnt clay is another material with which experiments have been made in road construction, and it is found to be desirable to use this material where macadam roads can not be made, at a cost of not more than one-third of the usual cost of the latter.

Dust prevention on public roads has received investigation in this country as well as in European countries. The materials used in the experiments of the Department have included, among others, tar preparations, asphalt, oils, such temporary expedients as calcium chloride, and several special preparations originating in the Department. The testing of road materials to determine their suitability for road building has reached a high state of efficiency in this Department.

Object-lesson and experimental roads have been constructed by the Department in many States, the construction of each road being made the occasion of instruction to persons concerned in the building and care of roads.

About 20,000,000 tons of blast-furnace slag is produced yearly in this country, most of which is a total waste. The Department has shown that this material, when combined with tar and asphalt preparations, is excellent for road construction. Experiments also indicate that a by-product of beet and cane sugar factories, now having little commercial value, is suitable for binding road materials.

The demands upon the Department for expert advice on road construction and maintenance have grown continuously in recent years both in volume and complexity, so that a corps of consulting highway engineers of the widest possible experience and adaptability has grown up, supplemented by specialists in various methods of construction and lines of experimentation.

PROGRESS IN SOME STATES.

Some States are rapidly giving more permanent construction to the principal highways. The State of New York in a recent year expended for this purpose more than $1,000,000; Massachusetts, about $575,000; Connecticut, about $220,000; New Jersey, about $250,000; Pennsylvania and Vermont, about $130,000 each. Among the States that have pushed this work the more rapidly are Massachusetts and Rhode Island, where about one-half of the mileage of the public roads is improved; Indiana and Ohio, with more than one-third improved; California, with about one-fifth; Connecticut, Kentucky, New Jersey, and Wisconsin, with more than one-sixth; and Illinois, Maine, Maryland, Michigan, New Hampshire, New York, Tennessee, and Utah with about one-tenth.

WEATHER SERVICE.

The field of daily telegraphic meteorological observations for forecast purposes, which in 1896 was limited to the United States and Canada, has been extended by the Department to embrace at the present time the whole northern hemisphere. Forecasts which formerly were limited to a period of twenty-four to forty-eight hours in advance are now frequently made from four days to a week in advance. In 1896 forecasts were telegraphed daily at Government expense to 1,896 distributing stations, from which points they were distributed by mail, telephone, railway train service, and railway telegraph service to 51,694 addresses without expense. On June 30, 1908, the daily forecasts were being telegraphed at Government expense to 2,334 distributing centers, from which points they were distributed gratuitously to 76,154 addresses by mail, 58,008 by rural delivery, 2,139 by railway telegraph, 852 by railway train, and 3,553,067 by telephone, making a grand total of 3,690,220 addresses, of record, receiving the daily weather forecasts without expense, except for the initial cost of telegraphing the information from the forecast district centers. The storm-warning display stations have been increased from 253 to 321. There has been an addition of 78 stations where daily meteorological observations are taken and telegraphed.

FEATURES OF THE WORK.

The output of daily weather maps has been increased about 25 per cent, and a number of large glass maps for the display of weather information have been installed at the boards of trade and chambers of commerce of the principal large cities of the country.

The number of cooperative stations where observations of temperature and rainfall are made for use in establishing the climatology of the country has increased by 621.

The field covered by the river and flood service, which in 1896 embraced only the principal navigable rivers, has been extended so as to cover every river of importance in the entire country, except where the lack of necessary facilities has prevented efficient communication; and the number of district centers has been increased by 30, the river-gauge stations by 231, and the rainfall observing stations by 69.

A research observatory was established at Mount Weather, Virginia, in 1903, for studying the upper air and investigating the higher problems of meteorology. Problems of water evaporation have been investigated at the Salton Sea and at principal reservoirs of the Reclamation Service. The ocean meteorological service, which has been transferred from the Navy Department to this Department, now includes reports from over 2,000 cooperative observers, and from these reports are prepared data for publication on the Pilot Chart issued by the Hydrographic Office. Buildings for use as meteorological observatories and living quarters for observers at stations have been erected or purchased at 37 places. Valuable works on climatology and meteorology have been prepared and published, including the climatology of the United States, a revised method for the reduction of barometric observations, and the preparation of new temperature and rainfall normals.

Great improvement has been made in the equipment of instruments used in the weather-forecasting service. A standard station meteorograph for the automatic and continuous registration of wind direction and velocity, sunshine, and rainfall has been developed and perfected, and every regular telegraphic reporting station is now equipped with it as well as with other automatic recording instruments, so that all local atmospheric conditions are now registered with great accuracy. A special meteorograph for use in upper-air exploration has been devised and brought to a high state of efficiency and is now used at the research observatory at Mount Weather.

To meet the demands for local meteorological data a form of street instrument shelter, or kiosk, has been devised, of neat ornamental design, for use in the parks or on sidewalks in busy parts of the larger cities. Within this shelter are displayed, behind protecting glass fronts, instruments giving continuous records of temperature, humidity, rainfall, etc., together with an appropriate display of daily weather maps, climatic charts, and other publications of special local interest.

The allotment of money for telegraphing and telephoning weather reports has been increased by 25 per cent during the period under review. New submarine cables have been laid from Key West to Sand Key, Florida; from Sleeping Bear Point to South Manitou and North Manitou Islands, Michigan; from Charlevoix to Beaver Island,

Michigan; and from Point Reyes to the Farallon Islands, California—these isolated stations being maintained for the benefit of extensive shipping interests.

FOREST SERVICE.

For Americans ten years ago forestry had neither a practical basis nor practical interest. On July 1, 1898, there were two professional foresters in the employ of the Government, less than ten in the whole country, no school of forestry on the Western Hemisphere, no scientific knowledge of the first principles of American practice in existence. The very word forestry was usually meaningless except as it was misunderstood.

FOUNDATIONS OF PRESENT POLICY.

The foundations of the present National Forest policy had, it is true, been laid. Yet so feebly were these foundations supported by popular approval and so dubious was the prospect for rearing a proper superstructure upon them that there was no security for their permanence. President Cleveland had by his proclamation of February 22, 1897, turned at a single stroke over 21,000,000 acres of public land into National Forests, but because of the belief that this action meant their withdrawal from use a storm of protest had led to the suspension of the effect of the proclamation for a twelvemonth, during which the whole reserve policy hung in the balance. The law of June 4, 1897, which accomplished this suspension, also laid down the lines along which the Government's forest policy has ever since developed by defining the purpose for which forest reserves could be created and authorizing their protection and administration; but not until more than half a decade afterwards was there an application of anything actually approaching forestry.

A complete change has been wrought in the attitude of the public toward the forests primarily and mainly by a knowledge of the facts shown by this Department. The change in public sentiment and the growth of forest service have been most rapid. The Department employed but 14 persons in 1897 in this work. Not an acre of land, public or private, at that time was under its care or receiving the benefit of its advice. There was no equipment for field work and frequently no information available upon which to base practical advice concerning forest management. The National Forests, with a total area of 39,000,000 acres, were about to receive for the first time some organized administration and protection through the General Land Office.

MAGNITUDE OF THE FOREST WORK.

At the beginning of the fiscal year 1909 the Department employed 3,753 persons in its Forest Service. Its expenditures for the year 1908

were over $3,400,000. It administered an area of National Forests which before the end of the year aggregated almost 168,000,000 acres, and which paid into the Treasury of the United States over $1,800,000 in receipts. It supervised the cutting and removal of the equivalent of over 524,000,000 board feet of timber under methods which provide not only for the renewal of the forest growth but also for the improvement of its character. It prosecuted studies to further the best use of forests and forest products throughout the United States. It proved its capacity to manage the actual practice of forestry on the entire area of National Forests, embracing about one-fourth the timbered area of the country, whenever the public need brings full use of all the forests. It is equally prepared to take the lead in introducing forestry wherever in the United States its practice is desired. It has solved the problem of preservation through use, and thereby holds in its hands for the service of the public the means by which one of the most fundamental of our natural resources may be maintained in full and permanent productiveness.

RECLAMATION ACT.

New lines of work are coming to this Department and to State officials charged with looking after agricultural interests in consequence of the law of June 17, 1902, known as the Reclamation Act. When this began to provide income from the sale of public lands for the reclamation of arid lands by means of irrigating works, a movement of great magnitude began under the Department of the Interior, the results of which are already beginning to appear. The receipts of money for this purpose, beginning with the fiscal year 1901, had amounted to $33,302,855 by June 30, 1906; the estimated receipts during the following four years ending with 1910 are $24,800,000; so that by the end of the year last mentioned $58,000,000 will have been received and mostly expended to promote agriculture on desert land.

In the prosecution of this reclamation service, many projects have been planned, the irrigated area of which, as now appears, will be about 2,300,000 acres, at a cost of about $90,000,000.

Some of these projects for reclaiming land by irrigation have bold features which give evidence of the large scale on which the Government is working to make the desert fruitful and to provide homes for hundreds of thousands of farming people—perhaps millions eventually.

SEVERAL PROJECTS.

The Salt River project in Arizona will irrigate 210,000 acres, and there must be made a tunnel nearly 2 miles long and a dam 1,080 feet long and 284 feet high, which will provide about 8,000 horsepower.

In the execution of the great Uncompahgre project in Colorado, which will irrigate 146,000 acres, it is necessary to excavate the Gunnison tunnel, about 5½ miles long, and another tunnel 2,000 feet long, besides excavating main canals for 77 miles and providing 5,000 to 10,000 horsepower.

The Minidoka project in Idaho, in its gravity project, will irrigate 84,200 acres, will have 130 miles of main canals and 190 miles of laterals, and provide 15,000 to 30,000 horsepower.

An irrigated area of 372,000 acres will be provided by the Payette-Boise project in Idaho, which will supply a power of 12,500 horsepower and utilize 200 miles of main canals and 100 miles of laterals.

A dam 6,200 feet long is part of the Belle Fourche project in South Dakota for irrigating 100,000 acres; the length of the main canals will be 100 miles, of the laterals 125 miles, and of the sublaterals 1,000 miles.

PRESENT AND FUTURE OF IRRIGATION AND DRY FARMING.

In 1896 the irrigated acres in this country numbered about 8,000,000; in 1908 the number is about 13,000,000, and, when projects now in the course of execution by the Reclamation Service and by private individuals under the Carey Act are executed, the total irrigable area will be 18,000,000 acres.

It therefore appears that during the period under review steps have been taken and much progress made toward placing under cultivation immense areas of desert land by means of irrigation and of so-called "dry land" by means of suitable cultural systems. The foundation has already been prepared for the advent of millions of people on previously unproductive land to pursue agriculture in many of its features under conditions which promise prosperity and an enormous addition to the Nation's permanent wealth and to its annual production. In these two lines of agricultural development, in which this Department has already been concerned in the agricultural phases, there is much work for it in the future.

AGRICULTURAL EDUCATION.

STATISTICS OF INSTITUTIONS.

The total income of the agricultural colleges was $5,000,000 in 1897, $15,000,000 in 1908; the value of their property was $51,000,000 in the former year and $96,000,000 in 1907. The students in 1897 numbered 4,000; in 1908, 10,000.

One agricultural high school existed in 1897, and there are now 55. Not one normal school taught agriculture in 1897, but now 115 do so, besides many privately endowed schools. About half of the agricultural colleges now give training courses for teachers in agriculture; 44 States and Territories give some instruction in elementary

principles of agriculture in the lower schools. The Graduate School of Agriculture for instruction of investigators and for discussion of advanced problems of research in agriculture was organized in 1902 and is now doing work under the American Association of Agricultural Colleges and Experiment Stations. A strong movement for the systematic organization of all agencies in agricultural extension work has been started within a few years, and the National Educational Association has added a department of rural and agricultural education.

Outside of schools which are for the education of youth and teachers in agriculture, the farmers have received a greatly increased degree of education by means of demonstration work and advice given orally and by letter, by countless official and private publications, by corn and live-stock judging contests, and by farmers' institutes. The number of sessions of the last named held in 1908 was 14,000, with an attendance of about 2,000,000 persons, an enormous increase over the attendance twelve years ago. About 1,200 trained lecturers are now employed in farm-institute work in all States and Territories.

NUMBER OF PUBLICATIONS OF THE DEPARTMENT.

The volumes and pamphlets issued by the States and Nation now number many millions annually, and supplementary to this is the circulation of the periodical agricultural papers, amounting to many millions more.

In 1897 the number of publications issued by this Department was 424, of which 6,541,200 copies were distributed; in 1908 the 1,522 publications of the Department were distributed to the number of 16,875,516. During the eleven years following 1897 this Department has printed 10,449 publications, including reprints, the distribution of which amounted to 129,129,633 copies. If the probable numbers of this year are added, the publications of the twelve years will be about 12,000 and the distribution about 146,000,000.

The Department Library has grown from 56,000 books and pamphlets in 1897 to about 101,500 in 1908. Exclusive of annual reports of societies and institutions, 1,850 periodical publications are regularly received. The increasing use of this great storehouse of agricultural information is having educational effects that penetrate to every part of the United States.

GROWTH OF THE DEPARTMENT OF AGRICULTURE.

So increasingly disposed has the public been to ask and receive the aid of this Department, and so large have been the new fields of work assigned to it by Congress, that the number of employees has increased enormously. On July 1, 1897, 2,444 persons were employed,

and eleven years later, in 1908, the number was 10,420, or over four times as many. Upon localizing this increase, it appears that the number of employees of the Weather Bureau increased from 1,075 to 1,705; of the Bureau of Animal Industry from 777 to 3,152; of the Bureau of Plant Industry from 127 to 976; Forest Service from 14 to 3,753; Bureau of Chemistry from 20 to 425; and small increases in other Bureaus and Offices. It is significant to note that the increase in number of employees is mostly due to service outside of Washington, in all parts of the country. The number of persons employed within Washington is 2,488, and elsewhere 7,932.

In 1896 the Department of Agriculture was made up of two Bureaus and a number of Divisions. Seven other Bureaus have since been organized and the work of the Secretary's Office has been developed into Divisions. The general change to bureau organization has greatly facilitated the work, which has rapidly grown in volume and in efficiency. There has been developed a remarkable force of scientists, administrators, and helpers. The number of seasoned workers now ready to administer the research, the police functions, and the business of the Department is sufficient for any reasonable demand for new work.

A scheme of project statements has been devised which is centering in the Secretary's Office a plan for each line of work undertaken by the Department. This plan has now been so far tried by the Bureaus and also by a number of State experiment stations that its general use is assured. It promises to serve not only as a most valuable means of having plans for work thoroughly wrought out by leaders in charge of projects, aided by workers along similar lines and their superior officers, but also to be a most efficient agency to systematize permanently the organization of the activities of the Department.

The State agricultural colleges and experiment stations and departments likewise have developed corps of workers who are prepared to guide the great advances imminent in research, in education, and in scientific breeding. The relations existing among all these organizations were never so cordial as now, and far more effective cooperation is in vogue than ever before. The administrative officers and workers of the Bureaus of the Department and of the State institutions, having had experience in many forms of cooperation among themselves, have wrought out many of the principles governing these intricate cooperative relations.

RESULTS OF AGRICULTURAL SCIENCE ON PRODUCTION.

Tangible evidences of the beneficial results of the gigantic movement in agricultural instruction and improvement, of the unprecedented uplift of the farmer, and the betterment of country life,

briefly outlined and indicated in the foregoing pages, are found in the wonderful increase in diversification and geographic extension of products, apart from any mere cultivation of new land, and are recorded with arithmetical precision by the increased production per acre of various crops for which facts are known.

It must be remembered that this country is passing through historical phases of agricultural production. First comes the exploitation of virgin land by the soil robber, a proceeding that is justified by the poverty of the settler or his lack of capital; next is the diminished production per acre, which surprises the farmer, and for which he is unable to account; next is the receipt of information from the scientist as to the means of improving the productivity of the land, with slow response; in the course of time, especially when the next or perhaps the third generation takes the farm, important advances are made, at first irregularly and mostly on the farms of the leading farmers, and subsequently with increasing diffusion and accelerated speed.

INCREASED PRODUCTION PER ACRE.

In the case of all crops for which production per acre is known, there was an increase during the last ten years and also, in a somewhat less degree, in the case of most of them, during the last twenty years. This is the general fact for the United States in spite of the damaging effect on the general average by reason of decreasing production per acre from land that has not yet entered upon the final historic stage of agriculture.

The farmers of this country have now made a creditable beginning in this last phase of historic agriculture. It is now a movement of masses as well as of leaders. It is more and more a diffused movement in place of being broken up into localized efforts. This movement has gained most of its headway during the last twelve years. Increased production per acre is clearly indicating the extent and force of this uplifting movement.

EVIDENCES OF A NEW AGRICULTURE.

During the ten years 1877–1886 the mean yield of cotton per acre in all States, new land and old being combined, was 170 pounds; during the ten years ending with 1896 the mean was 172 pounds; and the increase from that figure during the succeeding ten years ending with 1906 was to 191 pounds, or 11 per cent above the yield of the preceding ten years.

Most interesting now is the testimony of the older cotton States to the arts and sciences of agriculture. In North Carolina the mean production of cotton per acre increased from the ten years ending with 1896 to the ten years ending with 1906 by 21.8 per cent; in

South Carolina, 20.4 per cent; in Georgia, 15.9 per cent; in Mississippi, 16.9 per cent; and in Tennessee, 11.5 per cent.

Other crops join hands with cotton in swelling the evidence. Within ten years, mean figures being adopted as before explained, the production of corn per acre in Ohio increased 17.5 per cent, and in Virginia 18.3 per cent; oats increased 17.9 per cent in Indiana.

Wheat increased 16.2 per cent in New York, 45.9 per cent in Nebraska, 14.5 per cent in Maryland, 19.1 per cent in Virginia; barley increased 13.6 per cent in Wisconsin; rye, 24.4 per cent in Pennsylvania, 14.5 per cent in Michigan; buckweat increased 14.7 per cent in Maine and 21.9 per cent in Pennsylvania; potatoes 39.1 per cent in Maine and 22.1 per cent in Wisconsin.

Increase for hay was 14.3 per cent in Kentucky, 27.7 per cent in Minnesota, 19.4 per cent in North Carolina, 19.5 per cent in Georgia, 17.6 per cent in Alabama, and 30.8 per cent in Oregon.

In some degree this upward movement began twenty years ago, for during that time corn production per acre increased 25 per cent in Illinois and 21.7 per cent in Virginia; the production of oats increased 32.4 per cent in Maine; wheat increased 30.6 per cent in Iowa, 37.3 per cent in Nebraska, 23.4 per cent in Maryland, and 27.7 per cent in Virginia; rye increased 39.3 per cent in Pennsylvania; buckwheat increased 40.3 per cent in Maine and 26.9 per cent in Pennsylvania; potatoes increased 54.5 per cent in Maine, and hay increased 23.2 per cent in North Carolina, 32.8 per cent in Alabama, and 35.1 per cent in Oregon.

DIMINISHING RATE OF INCREASE IN POPULATION.

The most important meaning of the percentages of increased production per acre is found in a comparison with increase of population. The United States is accompanying the peoples of western and southern Europe in a decreasing birth rate and in a diminishing increase of population. The population of Europe, excluding Russia and Turkey, increased 8 per cent during the ten years ending with 1880, slightly less than 8 per cent in the ten years ending with 1890, and slightly more than 8 per cent in the following ten years. These people belong to the race stocks of the United States.

In this country the increase of population is complicated with an influx of the foreign born and with a higher birth rate of the foreign born than that of the old native stock. These are having a temporary effect upon the actual rate of increase; after an elimination of these temporary elements, which serve only to mislead to extravagant computations of population at distant years in the future, the natural rate of increase of the population of this country, native born of native parents, appears to be approximately 12½ per cent during a decade, or 1¼ per cent yearly, with a tendency toward diminution

in the rate. This conclusion has been elucidated by the Chief Clerk of the Bureau of the Census in recently published writings concerning this subject.

PRODUCTION AND POPULATION.

The percentages of increase of crop production per acre now have a new significance. No one need fear that the farmers of this country will ever be unable to provide for its population. They are already demonstrating in the cases of various crops and of various States that they can provide for a population increasing faster than by increase due to excess of births over deaths.

The wheat and rye production of 12 countries of Europe, representing substantially the entire production outside of Russia and Turkey, increased by 15.2 per cent from 1886–1890 to 1901–1905, and the population increased from 1888 to 1903 but 13 per cent.

WAGES OF FARM LABOR.

Extraordinary prosperity following the low financial condition of farmers a dozen years ago and earlier has enabled them to pay higher wages for farm labor than before, and this fact may indicate an improved condition of the farm laborer, at any rate to the extent that he is disposed to improve.

From 1895 to 1906 farm wages increased in a greater degree than prices did. The percentage of increase of prices of all commodities, according to recognized authority, was 35.8 per cent, while the wages of farm labor by the month for the year or season without board increased 38.4 per cent and with board 41.4 per cent; wages by the day in harvest without board increased 46.5 per cent and with board 55.4 per cent, and the wages of ordinary labor by the day without board increased 55.6 per cent and with board 61.3 per cent.

In the matter of wage increase the farm laborer has fared better than the workingman employed in manufacturing and mechanical industries.

STATISTICAL ASPECTS OF PROGRESS.

Precise ideas of the progress of agriculture, of the farmer, of his capital, of his production, and of his financial improvement may be obtained by a quantitative comparison between the average of the last five years ending with 1908 and the average of the five years ending with 1896 or thereabouts. The comparison will indicate by percentages of increase the advance that the farmer has made in twelve years.

INCREASE OF CROP PRODUCTION AND VALUE.

Cotton production increased 53.4 per cent and the total value of the crop 133.4 per cent; corn production increased 25.7 per cent, compared with the census of 1890, and the total value of the crop 110.5 per cent.

Wheat's increase is 39.8 per cent in bushels and 64.8 per cent in total value in comparison with the census of 1890. For rice the increase of production is 303.3 per cent; the barley increase is 98.2 per cent for bushels and 130.9 per cent for total value.

For potatoes the increase is 35.5 per cent in production and 118.9 per cent in total value; for tobacco 35.3 per cent for production and 98.3 per cent for total value. Since 1892–1896 beet sugar production has increased 1,404.6 per cent.

The value of all products of the farm this year is an increase of 216.2 per cent over the census value of 1889.

Horses increased 33.6 per cent in number since 1890 and 81.2 per cent in total value; mules increased 68.5 per cent in number and 132.1 per cent in total value. Sheep increased 90 per cent in number and 224.5 per cent in total value; swine increased 22.1 per cent in number and 56.4 per cent in total value. Cattle, other than milch cows, increased 48.4 per cent in number and 64.9 per cent in total value, and milch cows 28.4 per cent in number and 77.8 per cent in total value.

FARMING CAPITAL.

The number of farms in 1890 was 4,564,641; in 1900 they numbered 5,737,372; and the present number is estimated to be 6,100,000, an increase of 33.6 per cent over 1890.

The total number of acres in farms increased from 623,000,000 in 1890 to 839,000,000 in 1900, or 34.6 per cent. Improved acres increased 15.9 per cent.

The capital of the farmer in the forms of land, buildings, improvements, live stock, implements, and machinery is supposed to be now worth about $28,000,000,000, an increase of 75 or 80 per cent over 1890.

AGRICULTURAL EXPORTS.

The exports of agricultural products of domestic production have increased noticeably in value and in the case of many items greatly in quantity during the last dozen years. A comparison of the average for 1904–1908 with that for 1893–1897 discovers that the total agricultural exports increased 53.7 per cent in value, while the population increased 24.4 per cent from 1896 to 1908.

The increased value of the exports of packing-house products is 40.6 per cent. The exported lard gained 32.9 per cent in number of pounds and 52.6 per cent in value; oleo oil, 74.4 per cent in weight and 72.8 per cent in value; hams, 80 per cent in pounds and 90 per cent in value; salted and pickled pork, 121.8 per cent in quantity and 187.1 per cent in value.

The most prominent export, cotton, gained 40 per cent in pounds of export and 102.2 per cent in value; cotton-seed oil cake and oil-cake meal gained 115.5 per cent in quantity and 187.8 per cent in value,

and cotton-seed oil about the same. Fresh apples gained 130.8 per cent in number of barrels and 224 per cent in value; all fruits gained in export value 237.8 per cent.

The farmers have given to this country most of its balance of trade in the exchange of goods with foreign countries from the beginning. To whatever extent the subject is complicated with shipments of gold and silver and with transfers of credit is immaterial to the present mention of the subject. The fact is that the farmers of this country, through the exportation of their surplus of products, have been the chief instrument of strengthening the National credit abroad, of paying the foreign holders of the National bonds of this country, and of establishing credit in foreign countries against which drafts could be made.

During the twelve years under review the agricultural balance of trade increased from a yearly average of 234,000,000 to $411,000,000, or 75.7 per cent.

BANK DEPOSITS.

As an indication of financial results, a comparison of individual deposits in all banks July 1, 1896, with those of 1908 presents striking gains in agricultural regions. While Massachusetts and New York were gaining, respectively, 61.9 and 12.2 per cent in deposits, and the North Atlantic States 112.1 per cent, the North Central States west of the Mississippi River gained 258.5 per cent; Iowa, 285.5 per cent; Kansas, 333.7 per cent; Mississippi, 404.2 per cent; Oregon, 725.6 per cent; North Carolina, 405.4 per cent; and Arkansas, 534.7 per cent.

While these were not all farmers' deposits, yet they were mostly derived from the sales of farm products by farmers and the handlers of farm products.

FARMERS' COOPERATION.

Farmers' economic cooperation in the United States has developed enormously during the period under review, and it is safe to say that at the present time more than half of the 6,100,000 farms are represented in economic cooperation; the fraction is much larger if it is based on the total number of medium and better sorts of farmers, to which the cooperators mostly belong.

PROMINENT OBJECTS.

The most prominent object of cooperation is insurance, in which about 2,000 associations have probably 2,000,000 members. This kind of insurance costs the farmers only a very few cents per hundred dollars of risk above the actual losses.

The cooperative creameries number more than 1,900 and the cheese factories about 260, the membership of the two classes being very large and representing an immense number of cows.

With the exception of insurance, the greatest success in the farmer's cooperative movement is in selling. Associations to regulate, promote, and manage the details of selling the products of cooperating farmers are found in all parts of the United States. There is cooperation for selling by fruit growers, vegetable growers, nut growers, berry growers, by live-stock men, by the producers of cotton and tobacco, wheat, sweet potatoes, flax, oats, eggs, poultry, and honey. Farmers cooperate to sell milk for city supply, to sell wool, cantaloupes, celery, cauliflower, citrus fruits, apples, and so on with a long list.

Cooperative buying is conducted by about 350 stores in this country, a majority of which are mostly owned by farmers. This is chiefly the result of a very recent movement. Another form of cooperation for buying is based on the discount plan, as carried on by the granges, farmers' clubs, and various other associations of farmers with cooperative buying as either a primary or secondary object. Things bought in this way are all sorts of store goods; potatoes, wheat, etc., for seed; coal and wood, and a great variety of farm and family supplies.

Warehousing is conducted by farmers on the cooperative plan with success, particularly for the storage of wheat and corn. A cooperative cotton-warehousing movement is of recent date.

Cooperative telephone service has permeated vast regions, and the cooperative feature has kept the cost at the lowest figure, both of equipment and of service.

Cooperative irrigation is carried on by many thousands of associations in the arid and semiarid regions.

EDUCATIONAL, SOCIAL, AND ECONOMIC ASSOCIATIONS.

The progress of farmers in forming and expanding associations of an educational and semi-economic character has made great advances during the period under review. These associations are National in their scope, or are confined to State lines or to sections within States, and are devoted to the interchange of ideas and experiences, the assembling of information for common benefit, the holding of competitive exhibitions of products, the devising of plans for the common good, and business of a like character, and are concerned with special subjects, such as horticulture, floriculture, dairying, plant breeding, live-stock breeding, poultry breeding, the scientific aspects of breeding, forestry, agricultural education, fraternal associations with incidental educational and economic features, seed

breeding, agriculture, vegetable growing under glass, and the nursery business.

Important associations of the social sort, with incidental economic features, are farmers' clubs, many hundreds of which exist.

THE FARMER A GREAT ORGANIZER.

Altogether the number of farmers' cooperative economic associations must be fully 75,000, and may easily be many more, with a membership rising above 3,000,000, without counting duplicates.

Contrary to his reputation, the farmer is a great organizer, and he has achieved remarkable and enormous successes in many lines of economic cooperation in which the people of other occupations have either made no beginning at all or have nearly if not completely failed.

CONCLUSION.

The foregoing review of agriculture in the United States during the last dozen years and of the progress made by the farmer has necessarily been highly condensed, and from it has been omitted a vast amount of information which, being in the form of details, would detract from the review as it stands. Enough has been presented, however, to establish the fact that agriculture has made wonderful progress and permanent advancement, and that the farmer in results of information, intelligence, and industry has thriven mightily. The progress that has been made is in the direction leading to popular and National welfare, to the sustenance of any future population, as well as to a larger efficiency of the farmer in matters of wealth production and saving, and in establishing himself and his family in more pleasant ways of living.

Respectfully submitted.

James Wilson,
Secretary.

Washington, D. C.,
November 27, 1908.

THE ECONOMIC VALUE OF PREDACEOUS BIRDS AND MAMMALS.

By A. K. Fisher,

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GENERAL REMARKS.

As a class the predaceous animals have a most important function to perform in the economy of nature. Before man interfered with the intricate relations of wild creatures and disturbed the balance of nature, the carnivorous animals served admirably to prevent undue increase of the hordes that fed on herbage, seeds, fruits, and other vegetable life. So perfectly was the balance regulated that a temporary increase or decrease in one direction was followed sooner or later by a corresponding change in another.

But valuable as many predaceous animals are in aiding to maintain the balance of Nature, man looks askance at every mammal or bird that molests his poultry or the game of the State, and without regard to consequences sets out to kill everything that resembles the particular offender. He declines to give a mere pittance in return for value received, and visits indiscriminate persecution on the humble and faithful workers that have helped to save his harvest or orchard.

Most flesh-eating animals change their ordinary diet only under pressure of hunger. In the main they prey upon some abundant species, which, when available, furnishes almost their entire subsistence. For example, if meadow mice were always present, the red-tailed hawk would rarely touch other food. It is when normal food is scarce that predatory birds and mammals are from necessity forced to take what they can find and thus become trespassers. It is true that there are perverted individuals among animals, just as there are objectionable characters among men, and these by their overt acts tend to discredit their class as a whole. Yet the man-eating tiger and the poultry-eating skunk, weasel, and hawk are rare, though their deeds have been heralded far and wide and their names have become notorious.

In many cases—it might be safe to say in almost all—depredations by normally useful species are the work of exceptional individuals which for some reason depart from the habits of their kind. Thus

among the beneficial hawks and owls it has been found that the transgressors usually are immature birds, which, it is fair to assume, lack skill and experience in hunting their normal prey and consequently are forced to feed upon anything that offers.

A given species in a certain locality, and under what may be termed normal conditions of food supply, may be a most valuable factor in controlling a pest, while in another part of its range it may be undesirable on account of its inroads on poultry or stock. The great horned owl and coyote are examples in point. In rabbit-infested regions and in vineyards, orchards, meadows, or gardens overrun by field mice they are among the best friends of man; but in thickly settled regions comparatively free from rabbits and mice, both the owl and coyote have to be summarily dealt with, as also does the coyote in sections where sheep raising is an important industry.

Nature carefully safeguards the permanency and welfare of a species by making the healthy and virile individuals wary, agile, and elusive, so that their natural enemies are forced in the main to content themselves with the less favored individuals. The wolf that pulls down the sick or enfeebled deer, or the hawk that devours the crippled quail, is really benefiting the species it preys upon, though at the expense of the individual, since by the removal of the weak and unfit, more vigorous breeding stock is secured, and the danger of outbreaks of disease materially lessened.

It would be easy to define the economic value of all predaceous animals, were it not for the complications resulting from civilization, which introduces problems that materially affect the status of animated things.

It may be of interest to consider briefly the relations of some of the better known predaceous species.

WOLVES AND COUGARS.

In the present period of diminishing game supply and increasing live-stock interests, little can be said in favor of either the wolf or the cougar, animals that derive the greater part of their subsistence from big game, sheep, cattle, or horses. While they kill considerable numbers of rabbits and smaller pests, the good thus accomplished is rarely sufficient to offset the harm they do.

COYOTES AND BOBCATS.

In parts of the West where fruit growing and farming are dominant industries, it may be wise to encourage coyotes and bobcats within certain limits, provided poultry and sheep are properly protected at night. Numerous ranchmen and fruit growers have learned by experience that these animals if unmolested will free their prem-

ises from rabbits and other crop or tree destroyers. Where coyotes and bobcats have been allowed to do their work thoroughly they are fully appreciated, and many ranchers would almost as soon shoot their own dogs and cats as their wild benefactors. At times the coyote feeds entirely on large insects, as May beetles, crickets, and grasshoppers, and accomplishes much good.

THE HOUSE CAT.

Many an innocent hawk, skunk, owl, and weasel has been shot for the deeds of that sleek highwayman, the house cat. It is safe to say that this marauder, which enjoys all the comforts and protection of a home, destroys in the aggregate more wild birds and young poultry than all the native natural enemies combined. A cat has been known to kill a whole brood of chickens in a day, a feat unequaled by any predaceous animal, with the possible exception of the mink. Others in the course of a season have practically destroyed whole coveys of quail or grouse, or nests full of young songsters. A well-known naturalist estimates that in the New England States alone 1,500,000 birds are destroyed annually by cats.

The offender is not so often the well-fed household pet as it is the abandoned and neglected outcast. In 1905 the Society for the Prevention of Cruelty to Animals in New York City killed monthly an average of 6,000 sick, injured, or homeless cats—a total for the year of over 70,000. A considerable proportion of these were pets abandoned by people who had gone to the country for the summer. Moreover, summer visitors to the mountains or seashore sometimes take with them their cats, which, on their return home, are too often left behind to swell the local overflow and make serious inroads on the birds of the region. It is safe to assume that in the rest of the State outside of New York City as many cats follow a nomadic life as in the city, and if we assume that each cat kills one bird a week, we have a grand total of over 3,500,000 birds destroyed annually. In the milder parts of our country, as in the chaparral region of California, where bird life is abundant, cats often revert to a semi-wild state and never revisit their old homes except for plunder. Sportsmen and bird lovers should be ever watchful and whenever possible remove marauding cats from the coverts.

The principal reasons given for keeping cats are their attractiveness as house pets, their usefulness as companions for children, and their alleged value as rat and mouse killers. It is impossible at present to obtain correct figures on the subject, but it is safe to say that few persons during a normal lifetime run across more than half a dozen cats that habitually attack rats. Occasionally a hunter cat is found which seems to delight in catching rats, gophers, or ground

squirrels. It has been the common experience of the writer to find premises that were well supplied with cats overrun with rats and mice. At a certain ranch house in the West he trapped in his bedroom 12 mice in a week, although 8 cats had access to the place.

Lovers of the cat should be content with one, or at the most two, of these pets, and should see to it that outcasts do not run at large on their premises. Now that cats are known to carry in their fur the germs not only of ringworm, but also of such dreaded diseases as tuberculosis, diphtheria, scarlet fever, and smallpox, the presence in the household of Tabby is not without its dangers.

THE FOX.

The fox, from its occasional misdeeds, is looked upon by the majority of mankind as a deep-dyed villain that devotes its entire life to robbery and derives all its forage from the chicken yard or duck pen. As a matter of fact, even in localities where foxes are abundant, it is comparatively rare that poultry is destroyed by them. On all well-regulated farms chickens are housed at night, and the fox necessarily turns his attention to field mice, rabbits, ground squirrels, and insects, such as grasshoppers, crickets, and May beetles, to the great benefit of the farmer. Although it is true that the fox destroys a considerable number of birds, yet a ruffed grouse has been known to rear its young within 100 feet of a fox den, and the tracks of the young birds have repeatedly been seen on the fresh earth before the entrance. Among the food brought to the young of this litter and left outside were rabbits, mice, and a half-grown woodchuck, but no birds of any kind.

THE MINK.

The mink feeds on fish, crayfish, mussels, birds, and, like the weasel, is indefatigable in its search for meadow mice and other marsh-loving rodents. It is very fond of muskrats, and one of its most important services to man is the destruction of these pests about mill-dams, canals, and dikes, where their burrows undermine the embankments and cause disastrous overflows. The mink, although semi-aquatic, sometimes travels long distances from water in search of rabbits, ducks, and chickens. When it finds an unprotected poultry house, it sometimes contents itself with a single victim; at other times it kills all the inmates within reach. A single mink has been known to kill 30 or 40 ducks or chickens in one night. Fortunately such occurrences are rare and necessarily will become less frequent, since the demand for mink fur is constantly increasing.

THE WEASEL.

The weasel is one of nature's most efficient checks upon the hordes of meadow mice and other rodents which at times destroy forage crops, orchards, vineyards, and garden produce. It feeds also upon rabbits, squirrels, and birds, and in many sections its occasional inroads on the poultry yard have brought it into serious disrepute. It is of course desirable to kill particular individuals which have acquired the poultry habit, but farmers and horticulturists will make a mistake if they systematically destroy weasels.

THE SKUNK.

The skunk is another "chicken thief," which renders important service by destroying immense numbers of mice, white grubs, grasshoppers, crickets, cutworms, hornets, wasps, and other noxious forms. Although it prefers this kind of food, like the opossum it will eat almost any animal matter and also at times certain wild fruits and berries. It is said to be fond also of eggs and young chickens; but the writer has known a mother skunk to make her nest and rear her young in the inner walls of a chicken yard and neither egg nor fowl was molested.

The following well illustrates the close relations that diverse forms of animal life bear to one another and demonstrates how easily the natural balance may be upset: An extensive marsh bordering a lake in northern New York formed a suitable home for numerous ducks, rails, snapping turtles, frogs, and other aquatic life. The turtles deposited their eggs in abundance in the sand of the old beach. These delicacies attracted the attention of the skunks of the neighborhood, and their nightly feasts so reduced the total output of eggs that only a small percentage of the young survived to reach the protective shelter of the marsh. As time went on conditions changed. Skunk fur became fashionable and commanded a good price. The country boy, ever on the alert for an opportunity to add to his pocket money, sallied forth and captured the luckless fur bearer wherever found, so that within a comparatively short time the skunks almost wholly disappeared. When this check on their increase was removed, the snapping turtles hatched in great numbers and scrambled off in all directions into the marsh. When their numbers had been properly controlled by the destruction of a large proportion of their eggs, their food supply was adequate, but when they had increased many-fold the supply proved insufficient. Finally, through force of circumstances, the turtles added ducklings to their fare until the few ducks that refused to leave the marsh paid the penalty of their persistency by rarely bringing to maturity more than one or two young. It is not surprising that this great aggregation of turtles, containing the

essential of delicious soup, should have attracted the attention of the agents of the market men and restaurant keepers. The final chapter, the readjustment of conditions, may be briefly told: The marsh became a scene of great activity, where men and boys caught the voracious chelonians, and bags, boxes, and barrels of them were shipped away. There was also a depreciation in the value of skunk skins, with a corresponding loss of interest on the part of the trapper, so the progeny of the surviving skunks congregated at the old beach and devoured the eggs of the turtles that had enjoyed a brief period of prosperity. The broods of ducks now remained unmolested and attracted other breeding birds, with the result that the old marsh reverted to its original populous condition.

THE BADGER.

Badgers are valuable in destroying ground squirrels, gophers, and other burrowing animals, as well as various kinds of insects. They are extensive diggers and seem to have little trouble in securing their victims. For their valuable services full protection should be given them, even in irrigation sections, where they sometimes dig into dikes in pursuit of the rodents which in the rôle of dike borers cause so much trouble.

THE RACCOON.

Raccoons are omnivorous but rarely are abundant enough in thickly settled districts to do much harm except when they eat the fish in small artificial fish ponds and catch poultry which is left to shift for itself. In parts of the South where crayfish live in the levees and embankments, the raccoon does good service in destroying these troublesome crustaceans.

HAWKS AND OWLS.

The sooner farmers, ranchmen, horticulturists, and nurserymen learn that the great majority of birds of prey are their friends and deserve protection and that four or five species only are injurious, the sooner will depredations by noxious rodents and insects diminish. In the more thickly settled sections of the country, except at rare intervals, the goshawk, duck hawk, and great horned owl are so infrequent that years may pass without an individual being seen. Two species that need to be kept in check are the sharp-shinned and Cooper hawks, small and medium sized species which feed almost entirely on wild birds and poultry. The illustrations (Pls. I to III) will materially assist those interested in identifying these birds.

The important fact to bear in mind is that all hawks and owls feed largely on noxious rodents and the larger insects, such as grass-

GREAT HORNED OWL. ONE-FOURTH NATURAL SIZE.

SHARP-SHINNED HAWK—THE ENEMY OF SMALL BIRDS AND CHICKENS.

COOPER HAWK (CHICKEN HAWK).
[Upper figure, adult male; lower figure, immature female. One-fourth natural size.]

hoppers, crickets, and May beetles, and, from their size and voracious appetites, are important factors in reducing the numbers of such pests and keeping them under control.

OTHER BIRDS AND MAMMALS OF ECONOMIC INTEREST.

There is a number of species of birds and mammals, which, although they do not strictly belong to predaceous groups, are nevertheless at times extensively predatory in habits. Among the better known of these may be mentioned rats, squirrels, chipmunks, ravens, crows, jays, herons, and gulls.

THE RAT.

With the exception of the house cat, the rat probably kills more young chickens than any other animal. In some places where this rodent has become well intrenched, owners have found it next to impossible to profitably raise chickens. The marauders often become so bold that they catch passing chickens in broad daylight. Rats have been known to kill newly born lambs and pigs, and they frequently destroy the young and eggs of wild birds. This is especially true in suburban districts and on islands along our coast.

RED SQUIRRELS AND CHIPMUNKS.

During spring and early summer, when nuts and seeds are scarce, red squirrels and chipmunks are kept busy searching for food. This is the height of the breeding season of birds, and where the red squirrel is abundant it destroys great numbers of eggs and nestlings. This often happens where hawks, owls, weasels, and other enemies of the squirrel have been systematically persecuted and as a consequence squirrels have unduly increased.

HERONS.

It is well known that members of the heron family feed to a great extent on fish and other forms of aquatic life, and consequently do not live far from water. Two species, however, the great blue heron and the bittern, at times depart from the family traits and visit hillsides, cultivated fields, and drier meadows in search of pocket gophers, ground squirrels, and field mice, which they greedily devour. Pellets collected in one of the more inland nesting colonies of the great blue heron indicate that a very large proportion of the food of the young is made up of these injurious rodents. The remains of three pocket gophers have been found in one pellet, and a captured young bird regurgitated a like number. The herons, like other flesh-eating birds, digest their food rapidly and are disposed to gorge themselves when

opportunity offers. It is fair to assume as a low average that a pair of herons with 4 or 5 young will consume a dozen or fifteen gophers daily. We should not begrudge them the fish they eat when we remember that a gopher is capable of destroying trees large enough to produce marketable fruit.

GULLS AND TERNS.

The gulls and terns that live inland do effective service in checking the inroads of injurious insects and mammals. In spring, flocks of Franklin gulls fearlessly follow the plow and glean from the upturned soil many an insect that later would have attacked the growing crop. During the summer, and up to the time of their southern migration, the same flocks gorge on grasshoppers and crickets. The larger gulls, like the ring-billed and California gulls, feed on field mice and other small rodents, and in times of "mouse plagues" do effective work. Terns feed on grasshoppers and other insects, and in the South the black tern has been seen capturing the moths of the cotton-boll worm in flight over the fields of young plants.

RAVENS, CROWS, AND JAYS.

Ravens, crows, and jays also do effective work in destroying pests. Occasionally, however, in localities where they have increased out of proportion to the available food supply, they become troublesome by killing small chickens and by destroying eggs and nestlings of wild birds.

IMPORTANCE OF PROTECTING BENEFICIAL SPECIES.

It is demonstrable that so long as a useful species is kept within bounds and is not allowed to increase beyond its normal food supply, just so long will it fulfill its natural mission and be of true economic value. If, however, the staple food supply temporarily fails, then in the effort to maintain life the animal is likely to become obnoxious and may have to be controlled.

The annual loss of crops by insect and mammal pests in the United States amounts to many millions of dollars. Moreover, not only is this loss not diminishing, but on the contrary it is steadily increasing, partly as a result of the encroachments of new insect enemies, partly from the increase of both insect and rodent pests—for the number of these naturally grows with the extension of tillage—and partly, perhaps mainly, because of the destruction of their natural enemies. These, instead of being permitted to keep pace with the multiplication of the pests upon which they feed, have been destroyed until their numbers are entirely inadequate to preserve the balance. It is therefore of first importance that the farmer and stockman should everywhere seek to protect and encourage the natural foes of injurious mammals and insects.

THE WASTES OF THE FARM.

By A. F. Woods,

Physiologist and Pathologist, and Assistant Chief, Bureau of Plant Industry.

CAUSES OF AMERICAN WASTEFULNESS IN AGRICULTURE.

One of the characteristics of farming in this country as compared with farming in Europe is the apparent wastefulness of American methods. The truth of this is conceded, and it is clear that the reason for it has been due largely to the vast areas of fertile land to be had almost for the asking and the rapidity with which the land has been taken and utilized by men dependent largely on the resources of nature and their own brains and muscles. During this great preliminary expansion of agriculture, which has outstripped the growth of the other organs of our social body, agricultural products have been produced at a bare living wage. Every economy has been required by the conditions prevailing, and it has been necessary to borrow largely from nature's resources in order to live and lay the foundations for a better agriculture and civilization.

If the land has been given away, it has gone largely into the hands of virile men, who have built homes on it and who are making it a hundred times more valuable. If in this taming of a continent some mistakes have been made, they have been incident to the frontier days of National life and are not beyond correcting. We can plant better forests than ever grew wild; we can grow more forage on the ranges than ever grew there before; we can renew the fertility of our depleted soils and grow 100 bushels of corn where 10 grew in the olden days.

The time has now come when these better things can be accomplished. The economic independence which the American farmer has won through his part in the struggle has placed him in a position to adjust himself to the new requirements and conditions. He has been in the past and is to-day the greatest producer of wealth in the Nation. His raw products are the lifeblood of transportation, manufactures, and commerce, and these great and important parts of the social organism are as necessary to agriculture as agriculture is to them. They must be extended, developed, and improved as a part of the whole upward movement of the social organism.

LABOR ECONOMY.

The great agricultural, industrial, and commercial expansion of the last fifty years has forced every class of American business men, including the farmer, to economize labor. Not in all the history of the world has such progress been made in the development of tools and machinery for the saving of time and labor and the cost of production as during the last century in America.[a] Instead of being a great drawback to industrial expansion, the scarcity of labor has been its greatest stimulus and a blessing not only to America but to the whole world, because it has been the incentive for the development of labor-saving tools.

The prevention of waste of human labor on the modern farm is not only a great economic gain, but it has lightened the drudgery of farm labor and added intellectual stimulus. The value of the regular farm hand is now determined by his skill and directive ability, his honesty and reliability, rather than by his brute force.

Plowing has become an art. The modern steel turning plows, disk plows, and power plows of every conceivable sort, adapted to different soils, uses, and cultural requirements, call for judgment and skill rather than brute force in their use. They are made to economize power and labor and to put the soil into the condition essential for its best utilization for particular crops and conditions. When to plow, how deep to plow, and the kind of plow to use for a particular soil, season, crop, and system of farm management requires a knowledge far above that needed in the early days of the past century, when the soil was simply scratched with the old wooden or iron plow. Even the one-mule plow and the soil scratching still so common in many parts of the South are superior to the work of the old wooden plow of earlier days, and the one-third of a bale of cotton and the 10 bushels of corn per acre are produced with much less labor and more profit than in the earlier days of the last century. But what a contrast between the modern farmer of the South and the one-mule farmer!

THE ONE-MULE FARMER.

The one-mule farmer can scratch 3 or 4 inches deep with his one-mule plow from 10 to 12 acres in as many days. If he plows in the fall the winter rains wash his shallow soil away or repack it. He plants his cotton and corn with a little fertilizer, which he purchases with money borrowed by mortgaging his future cotton crop. His seed is simply ordinary cotton and corn. His cultivation of the growing crop is necessarily laborious and time consuming from lack of proper horse power and tools. He and his family are too busy

[a] See "Agricultural Production and Prices," Yearbook, 1897.

walking back and forth hoeing the weeds and grass out of the cotton and corn to look after a garden, to raise chickens and pigs, or to take care of a cow.

The one-mule farmer gets at best one-third of a bale of cotton and 10 bushels of corn per acre. The value of these hardly pays his rent, his fertilizer bill, and his bill for food and clothing. Year after year he goes through the same routine. His children escape to the first factory or mill that comes into their neighborhood.

THE MODERN COTTON FARMER.

But observe the modern farmer on a similar piece of land in the Cotton Belt. He has at least two good strong mules, and instead of pasturing them on brush and weeds he has a few acres seeded down to Bermuda grass or sorghum and cowpeas, or he has a winter pasturage of winter barley, oats, or wheat, mixed with winter vetch, crimson clover, or some other winter-growing legume. Besides eight months' good pasturage, he gets several tons per acre of good hay—enough to feed his mules and two cows such extra hay as they may require. He has an acre or two of alfalfa, if conditions are favorable, or peanuts, or cowpeas and sorghum for his hogs and other live stock. He has enough chickens to supply his own needs and some to sell. He has a small garden, where he raises some sweet potatoes, cabbages, tomatoes, and other garden truck for his own use. He spreads on his soil all the barnyard manure that he can make on the place and whatever additional quantity he can buy at a reasonable cost. He composts with manure all waste vegetable and organic matter of every kind that he can get hold of, including leaves, and when the material is decayed spreads it on his soil. He keeps his compost heap under a rough shelter to prevent the rain from washing out the nitrogen. He buys high-grade phosphoric acid and potash and puts them into the soil at the proper time and place to be promptly utilized by the crop. He plows his land deeply, gradually getting down 8 to 10 inches, stirring and loosening the soil. He harrows it thoroughly with a modern harrow. The plowing is done with a good team of mules and a good-sized modern steel plow. Instead of scratching 1 acre with a little one-mule plow, he thoroughly works 3 acres a day and usually turns under some green cover crop to add to the soil humus and nitrogen. He does not continually grow his cotton and corn on the same land, but he rotates his fields with cotton, corn, cowpeas, winter grains, etc. He does not simply plant cotton, corn, and cowpeas, but he carefully selects his variety and his seed and saves seed each year from the most productive plants. He plants his crops early and cultivates them well with modern tools that work thoroughly and quickly. After the cultivation is over he plants a cover crop, like bur clover, in his cotton, and cowpeas or vetch in his corn.

Instead of one-third of a bale of cotton per acre, the modern farmer gets from 1 to 2 bales; instead of 10 bushels of corn, he gets from 40 to 80 bushels, or even 100 bushels in some cases. He gets it easier, leaves his land richer, prevents it from packing and washing, makes a fair profit, and is thus able to make his home a pleasant place to live in. He keeps an account of all his farm projects and knows their profit and loss. He takes some journals and magazines and gets the publications in which he may be interested from his local State experiment station and from the United States Department of Agriculture. He sends his children to school instead of to the factory, and they grow up with more respect and love for farm life.

A similar contrast could be drawn almost anywhere in the United States. Many of the practices of the one-mule farmer are altogether too common even in the most progressive sections. How many farmers in any of our States have any system in their farm management, or keep a profit and loss account of their operations?[a] How many can tell what it costs to make a bushel of grain or a ton of hay, a pound of meat or butter, a quart of milk, or a dozen eggs? How many know what variety or kind of corn, wheat, or oats they are growing and the source, vigor, and productive efficiency of the seed? How many know the efficiency of the farm animals they are using or feeding for other purposes? One horse requires twice as much food as another to keep up a given working efficiency. One cow converts her food into milk, another into flesh; one produces twice as much milk or flesh from the same amount of food as another. One hen with a given amount of food lays 50 eggs in a season; another lays 200 under the same conditions. One variety of corn under given conditions yields 20 bushels; another under exactly the same conditions yields 40 bushels. One variety or strain of wheat yields 12 bushels, another 30. The crop or animal of low efficiency may be grown at a very small profit, or even at a loss, while that of maximum efficiency may be grown at the same or even less cost and give a large profit.

From the standpoint of soil and methods of cultivation, how many farmers have any system of crop rotation to keep their soils free from fungous pests and weeds? How many use barnyard manures or grow cover crops for the purpose of maintaining the humus and

[a] See Bulletin 48, Bureau of Statistics, "Cost of Producing Farm Products;" "Systems of Farm Management in the United States," Yearbook, 1902; "Diversified Farming in the Cotton Belt," Yearbook, 1905; Farmers' Bulletin 242, "An Example of Model Farming;" Farmers' Bulletin 272, "A Successful Hog and Seed-Corn Farm:" Farmers' Bulletin 310, "A Successful Alabama Diversification Farm;" Farmers' Bulletin 319, "Demonstration Work in Cooperation with Southern Farmers;" Farmers' Bulletin 325, "Small Farms in the Corn Belt."

nitrogen of the soil? How many take any account of the destruction of humus by cultural methods or the great waste of organic matter by burning straw, stalks, or leaves, instead of composting them or allowing them to rot in the soil? How many take any account of the elements of fertility shipped from the farm in its various products?

PLANT FOOD REMOVED FROM SOIL BY CROPS.

The following table,[a] taken from Bulletin 123 of the Illinois Agricultural Experiment Station, will give a good idea of the approximate maximum quantities of fertility which may be removed from an acre annually in farm products.

Maximum quantities of plant foods which may be removed from an acre annually in farm products.

Farm products.		Plant foods removable in products.			Market value of removable plant foods.[b]			
Kind.	Amount.	Nitrogen.	Phosphorus.	Potassium.	Nitrogen.	Phosphorus.	Potassium.	Total value.
		Pounds.	Pounds.	Pounds.				
Corn, grain	100 bushels	100	17	19	$15.00	$2.04	$1.14	$18.18
Corn, stover	3 tons	48	6	52	7.20	.72	3.12	11.04
Corn crop		148	23	71	22.20	2.76	4.26	29.22
Oats, grain	100 bushels	66	11	16	9.90	1.32	.96	12.18
Oat straw	2½ tons	31	5	52	4.65	.60	3.12	8.37
Oat crop		97	16	68	14.55	1.92	4.08	20.55
Wheat, grain	50 bushels	71	12	13	10.65	1.44	.78	12.87
Wheat straw	2½ tons	25	4	35	3.75	.48	2.10	6.33
Wheat crop		96	16	48	14.40	1.92	2.88	19.20
Timothy hay	3 tons	72	9	71	10.80	1.08	4.26	16.14
Clover seed	4 bushels	7	2	3	1.05	.24	.18	1.47
Clover hay	4 tons	160	20	120	24.00	2.40	7.20	33.60
Cowpea hay	3 tons	130	14	98	19.50	1.68	5.88	27.06
Alfalfa hay	8 tons	400	36	192	60.00	4.32	11.52	75.84
Apples	600 bushels	47	5	57	7.05	.60	3.42	11.07
Leaves	4 tons	59	7	47	8.85	.84	2.82	12.51
Wood growth	1/50 tree	6	2	5	.90	.24	.30	1.44
Total crop		112	14	109	16.80	1.68	6.54	25.02
Potatoes	300 bushels	63	13	90	9.45	1.56	5.40	16.41
Sugar beets	20 tons	100	18	157	15.00	2.16	9.42	26.58
Fat cattle	1,000 pounds	25	7	1	3.75	.84	.06	4.65
Fat hogs	do	18	3	1	2.70	.36	.06	3.12
Milk	10,000 pounds	57	7	12	8.55	.84	.72	10.11
Butter	500 pounds	1	0.2	0.1	.15	.02	.01	.18

[a] See Bulletin 123, Illinois Agricultural Experiment Station, "The Fertility in Illinois Soils," by Cyril G. Hopkins and James H. Pettit, 1908, p. 189.

[b] The value of the chemical elements is computed on the basis of market prices per pound for readily available plant foods in February, 1908, as follows: Nitrogen, 15 cents; phosphorus, 12 cents; potassium, 6 cents.

In the case of clover and alfalfa properly inoculated, while the amount of nitrogen removed is large, a considerable part of it comes from the air by direct fixation.[a]

Careful farmers give close attention to all these things. At present they are in the minority, but they are rapidly becoming more numerous through the influence of successful farmers and of the agricultural colleges, the experiment stations, and the agricultural departments of the States and of the Nation.

USE OF MACHINERY AND POWER.

While on some farms there is too little machinery and horsepower used to properly cultivate the land and save human labor, on others there is too much. Careful statistical studies of farms in Minnesota[b] have shown that horses are employed on an average only about three hours a day. At least two-thirds of their available energy, therefore, goes to waste, making the cost of the energy used very high. The same is true of expensive tools which are used only for a short period during the year. The interest on the money invested in them and the cost of deterioration and repairs considerably reduce the profits of production. A farmer needs to figure very carefully before investing in cornshellers, shredders, thrashers, power plows, etc., especially if the use of this needful machinery can be obtained by hire at a reasonable rate or cooperative ownership arranged. The latter method will doubtless be the final solution of the problem. There is, however, more to consider in the use of such machinery than the mere question of a few cents more or less profit. Freeing the man from slavish work in the process of production is the greatest thing and the greatest saving of all, even if it does cost more in dollars and cents.

Unnecessary weight and friction in the construction and working of machinery is also a cause of considerable waste of energy. American agricultural tools are much better in these respects than foreign tools, but great improvements, without sacrifice of strength or utility, might still be accomplished. The use of wide tires on wagons has made hauling easier and improved and packed rather than cut ruts in the roads. The farmer who still uses narrow tires for heavy loads is not only wasting time and horse energy, but is guilty of cruelty to animals and the destruction of the public highways. The relation between weight of load and width of tire and the maintenance of roads in each section should be carefully considered and fixed by local regulations.

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[a] See "Bacteria and the Nitrogen Problem," Yearbook, 1902; and "The Present Status of the Nitrogen Problem," Yearbook, 1906.

[b] See Bulletin 48, Bureau of Statistics, "Cost of Producing Farm Products."

PUMPING AND DISTRIBUTION OF WATER.

When any considerable quantity of water is used on a farm for stock or irrigation, it is usually necessary to pump it either into a storage tank, from which it is distributed as needed, or directly to the points where it is to be used. Usually the first considerations in locating a well are convenience, cheapness of construction, and certainty of striking an adequate water supply. The well is therefore usually located near the house or the barn, and often in a low place subject to seepage or surface drainage from the barnyard or outbuildings, thus contaminating the water with intestinal bacteria and sewage and making it dangerous to health.[a] Water thus contaminated may cause typhoid fever or similar intestinal diseases, contaminate milk, butter, and vegetables sold from the farm, and altogether directly and indirectly cause great loss and suffering to the farmer and to the country at large.

Often these bad wells have clear, cold, sparkling water, and it is hard to make their owners believe that, though the water may be pure enough chemically, if it is contaminated with pathogenic bacteria it can not be safely used without first destroying the bacteria and removing the source of contamination. If this can not be done, it is necessary to dig a new well in some location free from such danger. This should always be the first consideration in the location of a well. It may cost a little more to distribute the water, but it is money well spent. A pure water supply is one of the most valuable assets of a farm. The water should always be piped to the house, the barn, and the garden. The saving of labor much more than repays the cost of such distribution.

THE GARDEN.

Most successful farmers are careful to have a good garden. The part devoted to table vegetables and flowers is usually carefully fenced to keep out chickens, dogs, and stray animals, and the soil is made rich with barnyard compost. The women of the household usually take considerable interest in the garden and may direct its management. It should therefore be located as conveniently as possible to the dwelling house, but not in the front yard.

Too little attention is given as a rule to planning the cropping system of the garden. The tomatoes, cabbages, beans, peas, etc., must not be grown on the same spot each season, but, like other crops, must be rotated to prevent the accumulation in the soil of injurious insects, fungi, and bacteria. With a little planning a succession of vegetables, fruits, and flowers can be provided for the spring, summer, and

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[a] See "Hygienic Water Supplies for Farms," Yearbook, 1907.

fall, with a considerable supply for canning and for winter use,[a] and it is particularly important to see that the seed comes from a thoroughly reliable dealer and is of the very best. In the same way, the fruit trees should be ordered only from reliable nurserymen, the varieties being carefully selected.

Fruits and vegetables not only increase the healthfulness and attractiveness of the daily bill of fare, but they save a great deal of expense, and are far better than the stale garden stuff and the inferior grades of canned goods from the stores.[b] Farm workers thrive better, do more work, and are happier and more contented when well and properly fed. The farmer who sets a good table, well supplied with fruits and vegetables, is making the highest possible bid to attract and keep good farm help.

THE HOUSE AND THE YARD.

House conveniences to save work and increase the attractiveness of the home are now essential on a modern farm.[c] A good bath tub, with hot and cold water from the kitchen range, and a good drainage and sewage-disposal system are not expensive and are within the reach of every up-to-date farmer. Water should be piped to the house and the windows and doors should be carefully screened to keep out flies and mosquitoes. These two classes of insects are the greatest carriers of disease, the flies carrying typhoid, tuberculosis, and other disease germs and the mosquitoes carrying malaria or, in the South, yellow fever and similar diseases.[d] The loss in life and working efficiency through the agency of these pests is enormous every year in almost every part of the country.

Finally, the yard around the home should be made attractive and beautiful with trees and grass and flowers. They have a restful and uplifting influence on any tired soul and greatly increase the value and salability of the property, while the cost of planting and care is trifling.[e]

SYSTEM IN FARM MANAGEMENT.

In the past most farming was conducted with very little regard to system. Corn, wheat, oats, hay, and cotton were the staple crops

[a] See Farmers' Bulletin 154, "The Home Fruit Garden;" Farmers' Bulletin 203, "Canned Fruits, Preserves, and Jellies;" Farmers' Bulletin 255, "The Home Vegetable Garden."

[b] See Farmers' Bulletin 256, "Preparation of Vegetables for the Table;" Farmers' Bulletin 293, "Use of Fruit as Food;" Farmers' Bulletin 295, "Potatoes and Other Root Crops as Food," and others relating to the food value of vegetables and fruits and the culture of these crops, all of which can be obtained free of cost on application to the Secretary of Agriculture.

[c] See Farmers' Bulletin 270, "Modern Conveniences for the Farm Home."

[d] See Farmers' Bulletin 155, "How Insects Affect Health in Rural Districts."

[e] See Farmers' Bulletin 185, "Beautifying the Home Grounds."

grown year after year on the same land, often without manure, until the soil failed to produce satisfactory crops, when it was turned into pasture or allowed to run wild and produce weeds to seed down the rest of the farm. No records or books were kept, the cost of production was unknown, and what became of the product after it was sold from the farm was of little concern to the farmer. He took what he could get for it—often less than the cost of production—and a little later bought some of his products back in a slightly modified form but at a much higher price.

The age of specialization in industry took away from the farm the crude manufacturing arts and greatly improved and developed them. The farmer gradually gave up one thing after another until he was reduced to the production of a few raw products which had to be sold through the complex machinery of commerce and manufactures carefully organized to buy cheap, sell high, and save everything. But men who as boys left the farm and who were trained in this school of modern business have been going back again to the farm, taking these methods with them. Science and business are now being applied to the arts of agriculture with increasing thoroughness and skill.

The modern farmer must know the type of farming to which he himself is best adapted and where it can most profitably be conducted. If he is a dairyman, he must know the milk breeds of cattle and the best strains of the breeds for his conditions. He must know the feeding value of the various crops and the rations required to produce the best results. He must know all the sanitary regulations for keeping his milk pure and marketing it in the best condition. He must figure out the rotations of crops adapted to his conditions and his needs and with due regard to maintaining the fertility of his soil. He must know the conditions and the demands of his market and be able, through cooperative methods or otherwise, to get his products to the consumer without all the profits being absorbed in the process. And so with every other type of farming that succeeds in this new century.

Farming never can be organized so thoroughly as manufacturing, nor with profit along such narrow lines. The farmer will always have to deal with many forces and conditions only partially controllable even by men of the greatest knowledge and skill, but he has before him for development a wonderful field in this direction, and he is cultivating it with a zest before unknown.[a]

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[a] See "Cropping Systems for Stock Farms," Yearbook, 1907; Farmers' Bulletin 242, "An Example of Model Farming;" Farmers' Bulletin 272, "A Successful Hog and Seed-Corn Farm;" Farmers' Bulletin 280, "A Profitable Tenant Dairy Farm," and numerous other publications referred to in the papers already cited.

LOSS FROM POOR SEED.

The losses resulting from poor seed fall within five principal categories: (1) Seed not acclimatized or adapted to conditions, (2) seed of low producing efficiency, (3) seed of low vitality, (4) adulterated seed and weed seed, and (5) lack of trueness to type, or misbranded seed.

SEED NOT ACCLIMATIZED OR ADAPTED TO CONDITIONS AND OF LOW PRODUCING EFFICIENCY.

The importance of natural variation and differences in climate, in relation to agricultural production, has never been fully realized. As far as they are able, plants vary and adjust themselves to their environment. Under natural conditions only those survive which can modify their habits of growth so as to make a successful resistance to destructive influences and propagate their kind. The rest die. The longer a species or variety grows under a given set of conditions, the better each generation becomes adapted to grow and reproduce under those conditions. Those individuals which are less well adapted, and therefore less vigorous, continually give way to those which are better adapted, and therefore more vigorous.

When man enters in as a factor he may, and usually does in a considerable measure, interfere with these natural adjustments. He selects individuals and cultivates them for some natural peculiarity, and as a result intensifies these features; but unless he follows nature's methods and destroys the plants that are not best adapted to his conditions and requirements he soon gets a great mixture of individuals, good, bad, and indifferent, and cultivates them all together, receiving poor returns for his labor, and preventing, because of the natural crossing that may take place between them and the less desirable plants, the progressive development and improvement of the better individuals.

On the other hand, if he selects for propagation the individuals that give the best results under his peculiar conditions and prevents their crossing with the less desirable sorts, he soon develops a strain of high efficiency and productiveness for those particular conditions; but, like nature, he must continually select the good and persistently destroy the bad, or eventually lose all and see the variety "run out."

Selected seed of crops grown under severe limiting conditions will as a rule give good results the first year when grown under conditions less severe. The second generation, however, begins to vary and break up, and unless careful selection is practiced the crop soon becomes very unsatisfactory. For this reason many southern farmers think that they must each year get certain kinds of seed from the North, whereas from the variations occurring in their own fields they

might easily breed or select strains much better adapted to their conditions. This is true of practically every important crop.

When seed is taken from regions where limiting conditions are less severe to regions of greater severity, the crop may be killed outright, with no return, or marked variation may result the first year. A uniform strain of tobacco taken from a tropical or subtropical locality to one of the north temperate tobacco regions at once breaks up into fifteen or twenty distinct strains. By careful selection any one of these may be gradually fixed and adjusted to the new conditions if crossing is prevented. Cotton, corn, and other crops behave in the same way. These variations and adjustments result not only from climatic changes, but also from soil changes, such as the nature and concentration of salts in the soil, its physical condition, and the like.

Disease and insect pests also often destroy large numbers of individuals, leaving only the more resistant plants. If these are saved resistant strains can be developed. The great value of the straggling plant here and there that escapes some great epidemic or some cold wave, drought, or unfavorable soil condition should be appreciated and its seed saved. Many valuable adaptations have been secured in this way.

The great importance of selecting and growing seed under the conditions under which the future crop must be grown is now apparent. Careful experiments and the experience of careful growers have abundantly demonstrated the truth of the facts presented. Seed breeders and growers especially must give attention to these points.[a]

VITALITY OF SEED.

Assuming that every care has been taken to get seed well adapted to the conditions of culture, it is still important to see that the seed is of good vitality and capable of producing strong, vigorous plants. Great waste of land and labor results every year from the use of seed of low vitality. As a result of careful tests made by the Department of Agriculture of over 3,000 carefully selected ears of what was considered good standard seed corn, more than half of the ears were found to be of low vitality and unfit for seed.[b] By testing individual ears and rejecting those of low vitality, an average gain in yield of nearly 14 per cent could be secured as a result of the better stand and better productiveness of strong plants.

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[a] See "Relation of Plant Physiology to the Development of Agriculture," Yearbook, 1904; "Improvement of Tobacco by Breeding and Selection," Yearbook, 1904; "Improvement of Plants by Selection," Yearbook, 1898; "The Art of Seed Selection and Breeding," Yearbook, 1907.

[b] See Farmers' Bulletin 229, "The Production of Good Seed Corn," and Farmers' Bulletin 253, "The Germination of Seed Corn."

The same is true of other cereals. The seed of clover, alfalfa, and other forage crops and grasses often contains a considerable percentage of seed of low vitality, ranging all the way from 10 to 90 per cent in samples of different grades. Farmers often buy this cheap seed thinking that they are saving money, when as a matter of fact they are paying two or three times as much for the small amount of good seed obtained as they would pay had they bought good seed in the first place at twice the rate per pound paid for the poor seed.

An analysis of 61 samples of low-grade clover seed imported during the year ended June 30, 1906, showed the following average composition:

Red clover seed .... per cent..	74.06
Other seeds .... do....	12.17
Dirt and broken seeds .... do....	13.83
Live red clover seed in sample .... do....	43.16
Price paid per 100 pounds	$7.61
Actual cost per 100 pounds, based on percentage of good seed.	$20.39

More than 75 per cent of these samples contained dodder. Nearly 1,000,000 pounds of this poor seed were imported during the year mentioned.

An analysis of high-grade samples showed the following average composition:

Red clover seed .... per cent..	97.73
Other seeds .... do....	.85
Dirt and broken seeds .... do....	1.42
(Five kinds of weed seeds were found in the sample.)	
Live red clover seed in sample .... per cent..	96.55
Price paid per 100 pounds	$15.05
Actual cost per 100 pounds based on percentage of good seed	$15.58

Similar results were secured with seed of other forage crops and grasses.[a]

Poor seed can not produce good plants, and poor plants give poor returns or no returns at all. If good seed and poor seed are mixed, a poor stand is secured and the returns diminished accordingly. Small, light seeds are as a rule less vigorous than heavy, plump seeds. A difference in yield per acre of about 15 per cent was found between light and heavy cotton seed. A similar difference in yield, uniformity, and value of product was found between light and heavy tobacco seed and light and heavy radish seed; but when seed is of low vitality on account of old age or from any other cause the loss from its use is much greater, often amounting to a complete failure of the crop. Seed should always be tested before planting, and seed of low vital-

[a] See Hearings before Committee on Interstate and Foreign Commerce, House of Representatives, on bill H. R. 13835, 60th Congress, first session, relating to adulterated and misbranded seed; also Report No. 1278 on bill H. R. 13835.

ity rejected. It pays also to separate the light from the heavy seed and use only the latter. So far as its facilities permit, the Department of Agriculture is always glad to examine and test seed for farmers and seedsmen.

ADULTERATED SEED AND WEED SEED.

Some of this poor seed is introduced to blend with good seed so that it can be sold at a lower price. Some of the worst weeds, like dodder and Canada thistle, have been introduced and spread in this way. Some samples of imported seed have been secured containing as many as 80 different kinds of weed seeds. The loss from weeds and the cost of fighting them is great and is so well understood as to need no discussion.

MISBRANDED SEED.

There are many varieties of vegetables and flowers that have seed so nearly alike that even an expert can not tell them apart. However, the crops they produce are at once distinguished in the markets. Not only the variety but also the locality in which it is grown is very important. The western-grown Rocky Ford muskmelon seed looks exactly like the eastern-grown seed of the Netted Gem muskmelon, from which the former was derived by culture and selection in the West. If the farmer orders Rocky Ford seed and gets Netted Gem, his crop will not bring the high price of Rocky Ford melons in the markets.

Western-grown sweet corn seed produces a crop of 20 to 40 per cent lower quality than eastern-grown seed. Still, much of the seed corn sold in eastern markets is western-grown seed sold as eastern-grown. The market gardener or farmer who buys it suffers corresponding loss in the value of his crop. The same sort of substitution is often practiced by dishonest seedsmen with many kinds of vegetable seed, thus causing the farmer and the market gardener very great losses. The grower finds when he comes to harvest his crop that it is not what he contracted to supply and not what the market demands.

LOSS FROM PLANT DISEASES.

The loss from diseases as well as from insects [a] is very great in the aggregate, but is especially severe to individuals, as the loss is not usually evenly distributed, some growers suffering much more than others. After careful investigation of the diseases affecting all of our principal agricultural and horticultural crops, it is safe to say that as a general average not less than 10 per cent is annually destroyed by disease, and a similar percentage by insects. The total amount is therefore enormous.

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[a] See "The Annual Loss Occasioned by Destructive Insects in the United States," Yearbook, 1904.

DISEASES OF GRAIN CROPS.

In the case of our grain crops the principal diseases are rusts and smuts.

GRAIN RUSTS.—Rusts are most serious in damp years and where the season or soil favors soft, watery growth. This occurs in the Southern States nearly every year, and the grain crops in that section nearly always suffer severely from rust. A great epidemic of rust occurred in 1904 in the northern Mississippi Valley wheat region. The years 1902, 1903, and 1904 were all wet seasons for wheat, and the rust grew worse each year until in 1904 it caused great destruction of the crop. In North Dakota, South Dakota, and Minnesota the loss that year was estimated at from 25,000,000 to 40,000,000 bushels, with a farm value of about $25,000,000.

The greatest destruction was to the Blue Stem and Fife varieties. The durum, or macaroni, wheats recently introduced by the Department of Agriculture showed great resistance to rust, and gave good yields where the other varieties failed. This same class of wheat was also found to be more rust resistant in the South than the types like Fulcaster, Fultz, and May ordinarily grown there. The hard red wheats of Australian and Russian origin are also more rust resistant in the South than the ordinary varieties. Throughout the wheat regions the early-maturing winter varieties are higher yielding and, on account of their early maturity, escape the rust and insect injury better than the spring-sown sorts.

Oats and barley also suffer from rust, and, like the wheats, certain varieties are more resistant [a] than others.

GRAIN SMUTS.—The loss from grain smuts is very large, especially from the stinking smut of wheat and the loose smut of oats. The loss from these two diseases is estimated to average from $10,000,000 to $20,000,000 annually.[b] With the exception of the loose smut of wheat and barley, the grain smuts can be chiefly and easily prevented by soaking the seed in hot water or in sulphur or copper solutions.

DISEASES OF GRASSES AND FORAGE CROPS.

Grasses and forage crops are also often severely injured by rusts, smuts, and other diseases, the losses from such causes averaging not less than 10 per cent of the crops.

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[a] See Farmers' Bulletin 219, "Lessons from the Grain Rust Epidemic of 1904," and Bulletin 24, Division of Vegetable Physiology and Pathology, "Basis for the Improvement of American Wheats."

[b] See Farmers' Bulletin 250, "The Prevention of Wheat Smut and Loose Smut of Oats," and "The Grain Smuts: Their Cause and Prevention," Yearbook, 1894.

FRUIT DISEASES.

The various diseases of our cultivated fruits cause great loss nearly every year, not only to growers of the fruits, but also to the handlers and users.

POME FRUITS.—Over $5,000,000 worth of Bartlett pear orchards have been destroyed in California in the last five years by a bacterial disease, pear-blight. This disease has made it very difficult to grow the Bartlett and similar fine varieties of pears which are sensitive to the malady in question in any region where the disease has gained a good foothold. The culture of these finer varieties has been rendered extremely hazardous in the East.

The same disease also attacks the apple and in some seasons causes great loss by destroying the flowers and preventing the setting of the fruit, and often by attacking the trunk of the tree and girdling it. By the cutting out of the "hold-over" blight, supplemented by conservative methods of orcharding and the selection of resistant varieties, the blight can be at least partially controlled.[a]

The bitter-rot of the apple is another very destructive disease in the principal apple sections. The loss some years has been estimated to be over $10,000,000.[b] Until recently the disease could not be controlled, but now the Department experts have worked out an efficient and practical treatment.

Large losses of apples and pears also result from the attacks of black-rot or canker, leaf-spot, black-spot canker, fruit blotch, powdery mildew, scab, and a large number of similar diseases well known to fruit growers. Most of these diseases can be controlled by proper spraying.[c] This costs on the average about 10 cents per tree, but the majority of farmers and fruit growers still trust to luck, and as a consequence lose a large part of their fruit.

STONE FRUITS.—The diseases of stone fruits, especially of the peach and the plum, cause great loss annually. The gumming disease, or California peach twig-blight, has for several years destroyed a large percentage of the crop in California orchards. Recently the Department has demonstrated that by spraying the trees before December 15 the disease can be prevented. The recommended treatment has been applied, and the savings have already amounted to more than a million dollars a year.

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[a] See "Pear Blight: Its Cause and Prevention," Yearbook, 1895.

[b] See Bulletin 93, Bureau of Plant Industry, "The Control of Apple Bitter-Rot;" Farmers' Bulletin 243, "Fungicides and Their Use in Preventing Diseases of Fruits;" and Farmers' Bulletin 283, "Spraying for Apple Diseases and the Codling Moth in the Ozarks."

[c] See Farmers' Bulletin 243, "Fungicides and Their Use in Preventing Diseases of Fruits."

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The loss from peach leaf-curl, which in some seasons is almost complete, can be prevented by spraying the trees with Bordeaux mixture or lime-sulphur solution just before the buds begin to swell. This recommendation has been applied in many orchards and has resulted in a great saving.

The most destructive and serious of the stone-fruit diseases, however, are the yellows, rosette, and little-peach. These diseases, the causes of which are still unknown, have often destroyed entire orchards and each year still destroy millions of trees. They spread rapidly unless the diseased trees are immediately removed.

The Monilia or brown-rot is one of the most destructive of the fruit rots. In wet years it often destroys from 15 to 90 per cent of the peach crop in extensive regions, principally east of the Mississippi River. The disease is especially destructive to peaches, Japanese plums, and sweet cherries. The average annual loss will not fall below 25 to 50 per cent in the southern districts and 15 to 25 per cent in the northern. Hitherto there has been no method of preventing this loss. The copper sprays have been found to injure peach foliage to such an extent that they can not be used on trees in active growth. Recently a Department expert has discovered that the disease may be controlled to a considerable extent by spraying the fruit with self-boiled lime-sulphur solution. The solution thus made is found to differ in its effect upon the peach from the solutions made by the ordinary methods, being almost entirely noninjurious.[a]

SMALL FRUITS.—The blackberry and raspberry suffer especially from crown-gall, leaf-spot, and rust; the cranberry from scald and rot; currants from the cane-blight, leaf-spot, and powdery mildew; grapes from black-rot, brown-rot, downy mildew, and crown-gall. These diseases often destroy from 10 to 50 per cent of the crop in many localities. The most progressive growers, however, as in the case of the diseases of other fruits, reduce their losses to a minimum by various preventive measures, such as spraying, the growing of resistant varieties, etc.[b]

DISEASES OF VEGETABLE CROPS.

Among the diseases of vegetable crops it is simply necessary to mention asparagus rust, which causes from 20 to 50 per cent of injury nearly every year wherever this crop is grown; anthracnose, bacterial spot, downy mildew, and stem-rot of beans, all of which cause serious

[a] See Circular 1, Bureau of Plant Industry, "Self-Boiled Lime-Sulphur Mixture as a Promising Fungicide."

[b] See Farmers' Bulletin 221, "Fungous Diseases of the Cranberry;" Farmers' Bulletin 243, "Fungicides and Their Uses in Preventing Diseases of Fruits;" Farmers' Bulletin 284, "Insect and Fungous Enemies of the Grape East of the Rocky Mountains."

destruction of this crop; downy mildew, wilt, and leaf-blight of melons; early and late blight, rot, and wilt of potatoes; and a host of similar diseases of other vegetables, some of which can be prevented by spraying,[a] others only by the development of resistant varieties, which has been accomplished in several cases.

DISEASES OF COTTON.

Among the diseases of cotton the Texas root-rot, caused by a soil fungus, is one of the most destructive, but is confined chiefly to the State of Texas. It can be controlled only by cultural methods which bring about better soil aeration, such as deep fall plowing, the plowing under of green cover crops, and the use of liberal quantities of barnyard manure.

Another soil disease, the wilt, occurs in the lighter soils of the southeastern Cotton Belt, especially in the Sea Island districts, and causes the destruction of many thousands of acres of both Sea Island and Upland cotton. The wilt can be controlled only by the development of resistant strains of cotton.

Cotton also suffers from a number of other quite serious diseases, such as anthracnose, black-arm, etc.[b]

DISEASES OF OTHER CROPS.

Particular mention can be made of only a few of the host of diseases of shade and ornamental trees, forest trees, and crops grown under glass. The new bark disease of the chestnut promises to destroy this valuable native nut and timber tree. The white pine is suffering from several serious leaf diseases, which have destroyed many thousands of trees. The various wood and root rots cause great destruction each year to shade and forest trees.

The various diseases of the rose, the carnation, the violet, and the lily cause great loss annually to the growers.[c]

DISTRIBUTION OF THE LOSS.

While the loss from diseases and insects is very great, it should be understood that these losses come especially to two classes, (1) the careless grower, who does not adopt measures for controlling dis-

[a] See Farmers' Bulletin 91, "Potato Diseases and Treatment," and Farmers' Bulletin 231, "Spraying for Cucumber and Melon Diseases."

[b] See Farmers' Bulletin 302, "Sea Island Cotton: Its Culture, Improvement, and Diseases;" Farmers' Bulletin 333, "Cotton Wilt;" Bulletin 102, Part V, Bureau of Plant Industry, "The Control of Texas Root-Rot of Cotton."

[c] See "Fungous Diseases of Forest Trees," Yearbook, 1900; "Diseases of Ornamental Trees," Yearbook, 1907; "The Relation of Nutrition to the Health of Plants," Yearbook, 1901; "The Health of Plants in Greenhouses," Yearbook, 1895; "Progress in the Treatment of Plant Diseases in the United States," Yearbook, 1899.

ease or is inefficient in applying them, and (2) the consumer, who has to pay higher prices. The careful, intelligent grower usually makes the most money when the diseases which he can control or prevent are the most destructive to his competitor's crops and the prices are therefore high, the cost of control being very slight compared with the gain. These pests have in this way many times been the means of forcing better agricultural methods into use.

AVOIDING DISEASE BY ROTATION OF CROPS.

The accumulation of noxious weeds, diseases, and insects on the farm is one of the most serious sources of loss, as already suggested. This results as a rule from the constant growth or too long continued culture of the same crop or class of crops on the same land. Cotton wilt, melon wilt, flax wilt, cowpea wilt, tobacco wilt, clover and bean anthracnose, root-knot worms, affecting nearly all crops except cereals, bacterial diseases of the tomato, potato, eggplant, cabbage, and numerous other vegetables, the grain rusts and smuts, and weeds and insects too numerous to mention all accumulate in the soil under the one-crop system.

These pests often multiply to such an extent that ultimately it becomes impossible to secure profitable returns from land thus infested, no matter how good the other cultural conditions may be. Resistant varieties must then be secured or crops cultivated on land not subject to these pests. All these troubles, however, can be avoided and the fertility of the soil greatly improved by intelligent systems of rotation.[a] The most profitable systems for any locality or type of farming, so far as they have been developed, can usually be obtained from the State experiment stations or from the Department of Agriculture.

LOSSES IN MARKETING.

The price of a product depends, under natural conditions, on supply and demand. Supply depends upon the conditions of production and the facilities for transportation. Demand depends upon need or desire for the products and the ability of those needing or desiring the products to give something in return for them. If the supply at a certain point exceeds the demand, the price will normally

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[a] See Farmers' Bulletin 242, "An Example of Model Farming;" Farmers' Bulletin 245, "Renovation of Worn-Out Soils;" Farmers' Bulletin 299, "Diversified Farming under the Plantation System;" Farmers' Bulletin 310, "A Successful Alabama Diversification Farm;" Bulletin 102, Part III, Bureau of Plant Industry, "Planning a Cropping System;" Humus in Its Relation to Soil Fertility," Yearbook, 1895; "Systems of Farm Management in the United States," Yearbook, 1902; "Diversified Farming in the Cotton Belt," Yearbook, 1905; "Cropping Systems for Stock Farms," Yearbook, 1907.

be low. In the case of a market glut there is no sale at all for a large part of the product, and it may not even pay transportation expenses. This often happens with fruit and market-garden produce, but seldom with the staple crops, with the possible exception of corn. Some method of preventing an oversupply at particular markets is a great necessity. If fruits and vegetables could be distributed where needed, there would seldom be an oversupply.

It is doubtful, however, whether this can ever be accomplished with the great majority of crops of scattered production except through some central or National agency. In some districts where culture is intensive and the growers are well organized, as in the case of the citrus industry in California, cooperative marketing has proved a great success, but there are few plant industries sufficiently restricted in area to be organized in this way.

In nearly all cases, however, great saving is accomplished by cooperative marketing for particular districts, and associations for this purpose are springing up rapidly in all parts of the country. The product of many small growers is thus brought together, graded, and put on the market in better condition in carload lots, thus saving greatly in freight rates and in loss by handling. The market is selected with greater care and the middlemen are prevented from reaping all the profit. There are so many commission men who are both commission merchants and actual dealers in the same products that a grower takes great risk in making general consignments to men not known to be thoroughly reliable. Some method of preventing dishonest practices in connection with marketing must be found for the protection not only of the producer and consumer, but also of the honest commission merchant. The improvement will probably come through the development of the cooperative systems and the enactment of laws preventing commission men from dealing in the products which they handle on commission.

Although there has been great improvement in transportation methods and reduction in rates in the last forty years, as well as decrease in the cost of marketing generally, there is at present, in the case of certain special products, like fruits, vegetables, and flowers, too much waste between the producer and the consumer.[a] By the time transportation charges, commission charges, wholesale profit, and retail profit, with all the costs of handling, storage, dockage commission, etc., are paid, the cost of the product is often more than 100 per cent greater than the price the producer received for it.

The conditions controlling the great staple crops are much the same, although the relative cost of marketing is much less. The

[a] See "Development of Transportation in the United States," Yearbook, 1899; "Agricultural Production and Prices," Yearbook, 1897; "Truck Farming in the Atlantic Coast States," Yearbook, 1907.

great majority of farmers get comparatively low yields. The price of the product is fixed by the cost of production of the bulk of the crop. An average yield of 30 bushels of corn, with a farm value of 35 cents, would give a gross return per acre of $10.50; but it costs approximately $10 an acre to make the crop, leaving a possible profit above the cost of production of only 50 cents per acre. If drought, poor seed, or poor culture brings the yield down to 20 bushels per acre, the crop is produced at a loss at 35 cents, and would only pay the cost of production at 50 cents a bushel. Of course, the cost of production includes rent, interest on investment, depreciation, and wages, so that it pays to grow the crop even at the cost of production, especially if the grain and stalks are fed on the farm and the manure returned to the land.[a] By careful methods about 10 per cent of the farmers secure much larger yields than the average—often two or three times the average yield—and of course these men make very large profits. When this number increases so that the average relative cost of production is considerably reduced the price will be lowered, unless the demand increases relatively faster than the production, which is likely to be the case from present indications.[b]

Every possible saving must be accomplished in the cost of production and marketing. Consequently the farmers are organizing their own cooperative warehouses, elevator systems, and trading facilities and demanding legislation to control railroad rates, grading, weighing, etc. It is necessary that every farmer and consumer should take an active and careful interest in these matters that so greatly affect the profits of labor and the cost of living.[c] There is no good reason why the necessities of life and even its luxuries can not be supplied at less than the present cost by improved methods of production and by cutting out all unnecessary wastes.

It should be clearly understood that not all of the trouble and dishonesty in the marketing of crops is to be attributed to the transportation companies and middlemen. The average farmer does not pay enough attention to market demands and requirements. If he allows weeds to grow in his hay and grain fields, he will take weedy hay to the market and his grain will be full of weed seeds. The prices will

[a] See Bulletin 48, Bureau of Statistics, "Cost of Producing Farm Products." The cost of producing corn in Minnesota, ears husked from the standing stalks, was $9.95 to $11.77 per acre; cut, shocked, and shredded, $14.74; cut, shocked, and hauled in from the field, $11.02. These estimates are based on a yield of 40 to 45 bushels.

See also "Agricultural Production and Prices," Yearbook, 1897.

[b] See "Causes Affecting Farm Values," Yearbook, 1905.

[c] See "The Organization of Agriculture," by E. A. Pratt; "The Transition of Agriculture," by E. A. Pratt; "The American Farmer," by A. M. Simons; "The Modern Farmer," by Edward Adams.

be cut accordingly; sometimes excessively. If he does not produce the right varieties of fruits and vegetables and send them to market properly and honestly packed according to his market requirements, he can not expect the best prices.

Some of the fault found with middlemen and markets is really due to ignorance and carelessness on the part of the producer. The great losses to the citrus-fruit industry in Florida and California in the rotting of fruit in transit have been shown to be due to careless methods of picking and packing the fruit rather than to any fault of the transportation companies. These losses, amounting to from 15 to 40 per cent, have been almost entirely eliminated by the use of more care in picking and packing.[a]

OTHER WASTES.

Space forbids a discussion of the waste from inconvenience of location of fields and buildings; the lack of organization and tools for different types of farming; the relation of type of farming to markets, climate, soils, labor, and personal preferences and ability; the danger from fads and revolutionary practices unless the whole situation is carefully considered; the relative cost and value of different forms of power; loss from systems in which labor is not kept fully employed on the farm and from the fluctuations in labor needs; loss from failure to make the best use of the land—idle land, roadsides, fence corners, etc.; loss from lack of facility for storing products in order to market to advantage; loss from unmarketable products and the failure to utilize such products for feeding, canning, the manufacture of alcohol, etc.; loss from lack of proper education and training of farm managers and workers; loss from wrong types of cooperative organization in buying, selling, and borrowing; loss from lack of credit, which is the foundation of modern business procedure and is based on honesty, reliability, and fair dealing. Derangements in all these and other directions are responsible for considerable waste.

GENERAL AWAKENING.

For the past ten years there has been apparent to all interested in agricultural production a rapidly increasing interest in improved methods all along the line. There is a strong demand for men better

[a] See Bulletin 123, Bureau of Plant Industry, "The Decay of Oranges while in Transit from California;" "The Influence of Refrigeration on the Fruit Industry," Yearbook, 1900; "Relation of Cold Storage to Commercial Apple Culture," Yearbook, 1903; "The Handling of Fruit for Transportation," Yearbook, 1905; "Freight Costs and Market Values," Yearbook, 1906; "Consumers' Fancies," Yearbook, 1904: and Farmers' Bulletin 62, "Marketing Farm Produce."

trained in the business and art of farming and farm management. The methods of the men who have made a success of farming are being studied. The improvement of soil and the use of fertilizers are now problems of interest to most farmers in all parts of the country. Higher-bred crops and animals now interest the many instead of the few. The control of diseases of plants and animals is receiving more general and intelligent consideration. Better marketing methods, the improvement of farm sanitation and home conditions and life in general on the farm and its relation to the general welfare are uppermost in the minds of a rapidly increasing number, not only of farmers, but of the public generally. The wonderful progress made on American farms in the last century is but the beginning of a much greater development in this new century.

SOME FACTS ABOUT TUBERCULOUS CATTLE.

By E. C. Schroeder,

Superintendent of Experiment Station, Bureau of Animal Industry.

TUBERCLE BACILLUS THE INDISPENSABLE CAUSE OF TUBERCULOSIS.

Tuberculosis or consumption, alike of persons and cattle, is an infectious disease, caused by the growth and multiplication of a very minute plant in the bodies of its victims. The little plant, which can not be seen without the aid of a microscope, makes up for its small size by the rapidity with which it multiplies under favorable conditions. It is shaped like a little rod and is known as the tubercle bacillus, and it is the one absolutely essential and indispensable cause of tuberculosis. Without it the disease does not and can not occur, no matter how many conditions favorable to its development are present.

The tubercle bacillus grows and multiplies nowhere in nature but in the bodies of tuberculous persons, cattle, and other animals, but it can live separated from these bodies for periods of time that vary in length according to the conditions by which it is surrounded. In sunlight it dies very rapidly, and in dark and damp places, protected from light and drying, it may live many months.

One thing is absolutely true of all organisms: They are, without exception, the descendants, the progeny, or the offspring of parent organisms of their own kind. The tubercle bacillus is an organism and therefore must be derived from and must be the direct descendant of a parent tubercle bacillus. A tubercle bacillus can no more come into existence without a parent tubercle bacillus than, for example, a cornstalk can come into existence unless it does so as the offspring of a parent cornstalk. The body of an animal can not create or spontaneously generate a bacillus any more than a seedless patch of earth can spontaneously originate a cornstalk. Hence, as the tubercle bacillus is the indispensable cause of tuberculosis, and grows and multiplies nowhere in nature but in the bodies of tuberculous subjects, it follows naturally that every case of tuberculosis is the direct result of infectious material, expelled from the body of a previously tuberculous subject, that has found its way into the body of a subsequently tuberculous subject.

We can not reasonably fail to conclude from these facts that it is of the highest importance, in a fight for the suppression and eradication of tuberculosis, to know how tubercle bacilli are scattered from the bodies in which they grow and how they are introduced into the bodies of their later victims. No evil can be successfully combated unless we direct our attack primarily against its essential cause, and just as the tubercle bacillus is the indispensable cause of tuberculosis, the essential cause of the widespread and common occurrence of tuberculosis is the dangerous expulsion of tubercle bacilli from the bodies of tuberculous subjects, human and animal, and their introduction into the bodies of healthy persons and animals.

As we are dealing with cattle in this article, we shall not discuss how tubercle bacilli are expelled by tuberculous persons beyond making the statement that practically only those tubercle bacilli thrown off through their mouths and noses are important factors for public health. It may be well to add that the dangerous expulsion of tubercle bacilli by consumptive or tuberculous persons, limited as it is almost wholly to one small region of their bodies, presents many complexities and difficulties when we consider the enormous number of persons who are affected with tuberculosis and the numerous ways in which infectious material may be transferred from place to place.

TUBERCULOUS DAIRY COW A DANGEROUS SOURCE OF INFECTION.

The greatest tuberculous danger to which animals are exposed, and likewise the greatest tuberculous danger for public health that has its origin among animals, is the tuberculous dairy cow, and dairy cows are more commonly affected with tuberculosis than other cattle and other kinds of animals.

Tuberculous cows expel tubercle bacilli from their bodies mainly with the ejecta from their bowels, but also with the material sprayed, slobbered, and otherwise discharged from their mouths and noses during coughing, feeding, etc., and also at times directly with their milk.

When milk is infected directly through the udder it is exceedingly dangerous, because the tubercle bacilli it contains are apt to be numerous and of the freshest and most virulent kind. All cows affected with udder tuberculosis expel tubercle bacilli directly with their milk, and some authorities believe that many cows, especially advanced cases of more or less generalized tuberculosis, also do so, though no tuberculous disease can be detected in their udders.

Of equal importance to its direct infection, because it is of commoner occurrence, is the indirect infection of milk with tubercle bacilli. For this reason the expulsion of tubercle bacilli by tuberculous cattle with the ejecta from their bowels is a seriously pernicious condition, as we can readily see when we think of it in connection with the three following facts:

First. The examination of many samples of milk, purchased from dairymen and dealers under ordinary market conditions, revealed, at the Experiment Station of the Bureau of Animal Industry, that commercial milk, or the kind commonly sold in our cities, wholly free from contamination with material expelled from the bowels of cattle, is a comparatively rare article. The same fact was revealed by the examination of a large number of samples of milk at the Hygienic Laboratory of the United States Public Health and Marine-Hospital Service.

Second. The amount of material passed each day from the bowels of a cow of average size is about 30 pounds. This means an enormous amount of infectious material in the dairy stable when the cow is affected with tuberculosis. The milk obtained from tuberculous cows, as well as from healthy cows in the same herd, may easily become contaminated in the presence of so much infectious material. The tubercle bacilli in the ejecta from the bowels of tuberculous cows are evenly distributed throughout the entire mass, so that all of it, and not only some portion, is dangerous.

Third. The tuberculous cows that expel tubercle bacilli from their bowels frequently begin to do so long before they show signs of their diseased condition.

CONCEALED CHARACTER OF THE DISEASE.

As it is the often long-concealed character of tuberculosis through which it is especially dangerous when it affects animals that are valued, like dairy cows, because an important article of food, like milk, is produced within and is daily drawn from their living bodies for long periods of time, this concealed character must be regarded as one of the important facts about the disease, and as too many persons are inclined to take for granted that a dairy herd is free from tuberculosis simply because the cows of which it is made up look and act like healthy animals, it seems desirable to clearly define this concealed character.

Tuberculosis may be acute and progress rapidly from infection to death. But this is very rare. More commonly it is an insidious, slowly progressive, chronic disease, the beginning and early stages of which are rarely recognized. It may attack and remain confined to any one part of the body; it may attack many parts in succession, one after the other, or it may attack several or many parts simultaneously. Its encroachments are so gradual that the body can adjust or adapt itself to the changes the disease causes until they have become very extensive, without giving external evidences of the struggle to do so, and often the disease progresses to nearly its fatal termination in cattle without showing a well-defined symptom or an observable sign of its presence.

The body of an animal can adjust itself to great changes that are of slow growth because all its organs and different parts are naturally much larger, stronger, and more capable than they need to be to serve the ordinary, usual vicissitudes of life. The difference between the actual and the commonly required vigor and capability of the body, or one of its parts, is known as the factor of safety.

Through the existence of this factor chronic diseases, like tuberculosis, which do not seriously shock the body by rapidly or suddenly overwhelming one or more of its parts, as acute diseases often do, may continue their destructive operations a long time without a manifestation of well-marked symptoms. In fact, the destructive changes may and often do progress without observable signs of their existence until the factor of safety of some important organ has been nearly or wholly destroyed—that is, until a fatal termination is close at hand.

An example may serve to give a clearer idea of what the factor of safety really is. The general, visible, bodily condition of the cow shown in Plate IV, figure 1, is well nourished and good; she is rather fat for a dairy cow, though she is affected with advanced tuberculosis. The location of the disease, shown to some extent by the position of her head, is in the glands of the throat, near the root of the tongue. The glands are greatly enlarged, and because of their size and position press on and narrow the upper portion of the passage through which air reaches the lung. The opening through which the breath of the cow must pass has its caliber, its original efficiency to admit air, reduced so much through the pressure of the tuberculous glands that her breathing becomes painfully difficult after she has walked less than a mile; if she should be driven a mile at a rate of speed which would not seriously affect a healthy cow, there is no doubt that she would collapse and die of suffocation. The amount of air that can find its way through her narrowed air passage is sufficient to keep her in excellent condition; it is all that is needed for the customary or usual vicissitudes of her routine life, and the difference between what it is and what it was before she contracted tuberculosis is a factor of safety that has been lost.

A factor of safety comparable to the normally liberal size of the passage through which air reaches the lungs of healthy animals is possessed by every organ of the body. Half of the lung may be destroyed by tuberculosis without causing death; we can still see when one eye has lost its vision; one kidney is sufficient for the maintenance of life; and so on with every organ. The fact that this so-called factor of safety of any one organ or of several organs of a cow may be almost wholly obliterated by tuberculosis before externally observable symptoms of the disease assert themselves should be kept in mind by those who desire to free their herds from tuberculosis, by

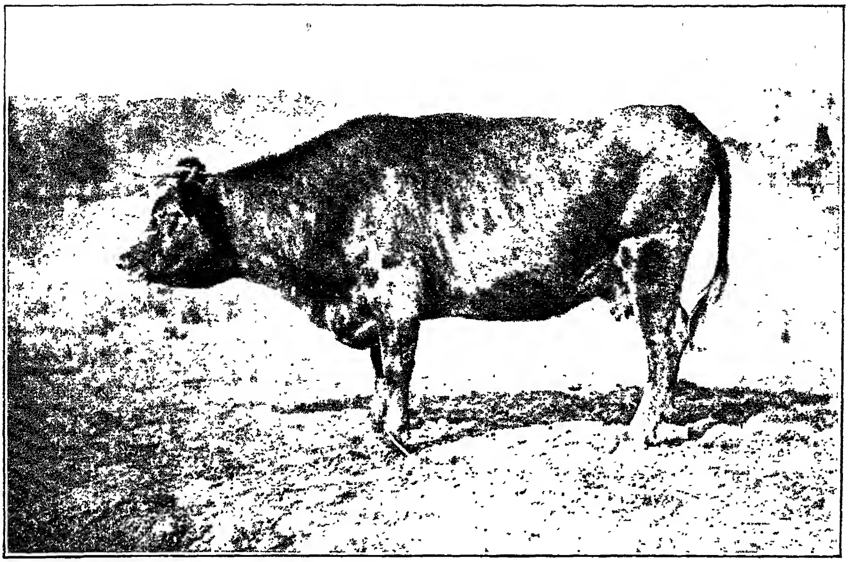

FIG. 1.—A COW IN A WELL-NOURISHED CONDITION AFFECTED WITH ADVANCED TUBERCULOSIS OF THE THROAT LYMPH GLANDS.

[The pressure of the enlarged glands has narrowed the upper air passages so much that the least exertion is followed by painfully labored breathing.]

FIG. 2.—THREE TUBERCULOUS COWS.

[The two at the right of the picture expel tubercle bacilli with the ejecta from their bowels, and probably also do so with the material slobbered from their mouths during eating. Tubercle bacilli that are passed from the bowels of cattle usually have their origin in the lungs and throat, from which regions they reach the bowels by being coughed into the mouth and swallowed. The visible condition of the cows shows nothing of their dangerous tuberculous character.]

FIG. 1.—THREE TUBERCULOUS COWS.

[The one in the center of the picture expels tubercle bacilli from her bowels and probably also from her mouth. The visible condition of the cows is better than that of most dairy cattle; they show no observable symptoms of the disease with which they are affected. Such cows, because of the germs they scatter, are a source of great danger to other animals, and the use of their milk, either as a beverage or in the form of other dairy products, is a menace to public health.]

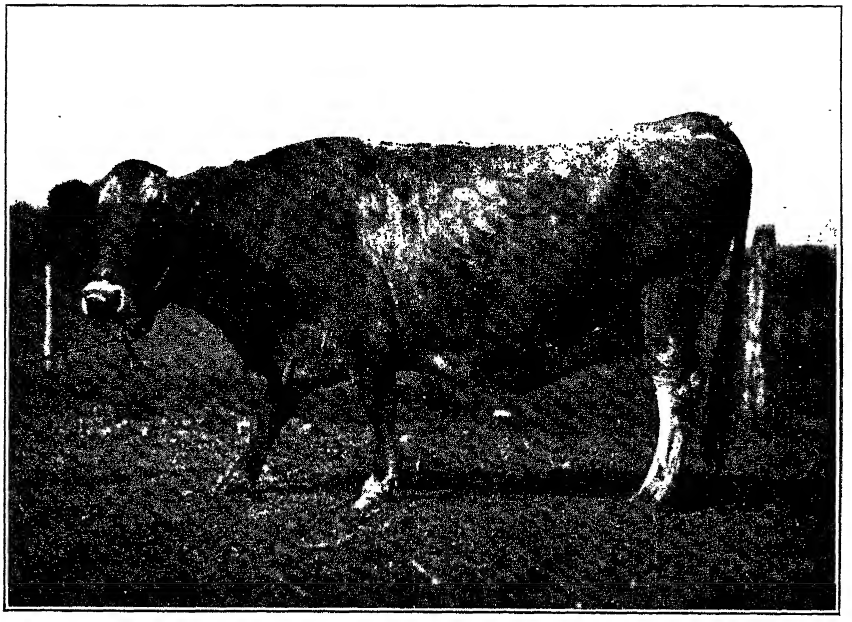

FIG. 2.—A DANGEROUSLY TUBERCULOUS COW.

[Notwithstanding her excellent bodily condition and bright appearance she is known to expel tubercle bacilli with the ejecta from her bowels and probably also does so with the material slobbered from her mouth. She shows absolutely no symptoms of disease; at the time her picture was taken she had been known to be tuberculous about two years. The enormous tuberculous masses sometimes found on post-mortem examination in the bodies of cows similar to the one in this picture cause great surprise, and demonstrate that life and apparent health can be maintained under extremely adverse conditions that are of slow and gradual development, like tuberculosis or consumption.]

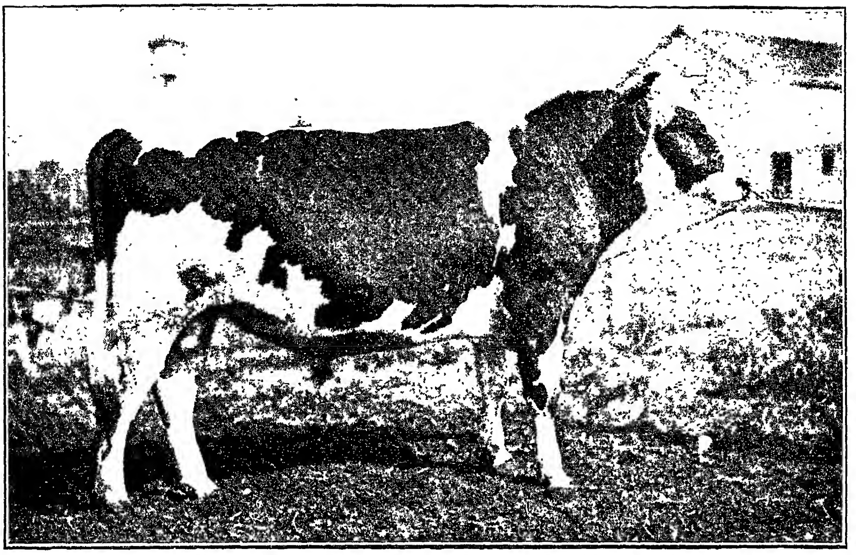

FIG. 1.—A TUBERCULOUS BULL KNOWN TO PASS TUBERCLE BACILLI WITH EJECTA FROM HIS BOWELS.

[Where tubercle bacilli can be detected in the ejecta from the bowels the number expelled from the body is very great, and animals that expel them in this way are exceptionally dangerous to other animals and to public health. Tuberculosis is an infectious disease, and we must always bear in mind that it can be and is communicated from animal to animal and from animals to persons.]

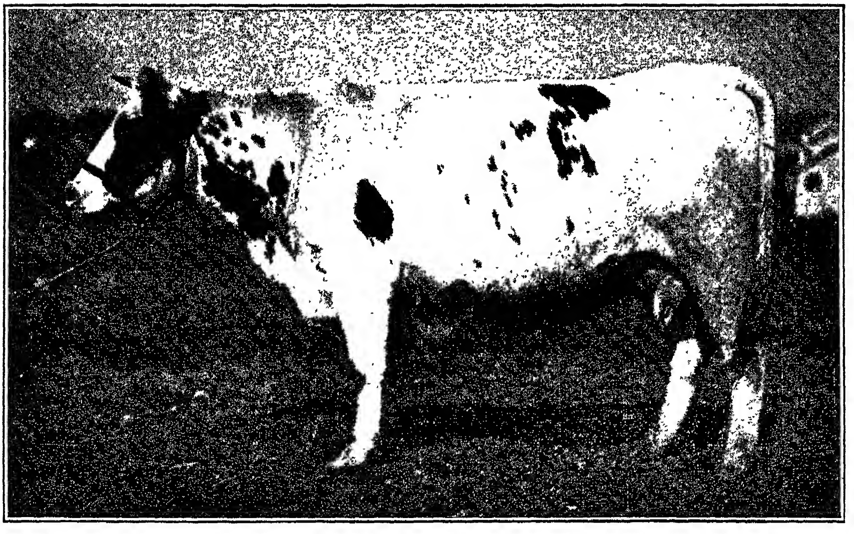

FIG. 2.—A TUBERCULOUS COW.

[This animal, at the time her picture was taken, was an unusually dangerous source of tuberculosis, because of the exceptionally large number of tubercle bacilli expelled from her body. Without the tuberculin test she would not have been known to be tuberculous, and without special tests her uncommonly dangerous tuberculous character would not have been suspected. It is not always possible to determine precisely how tubercle bacilli are expelled by individual tuberculous cattle; the tests for this purpose require too much time and careful observation for practical application. It is well to assume that every tuberculous cow expels tubercle bacilli, because if she does not expel them at any one time she will do so sooner or later in the course of the disease.]

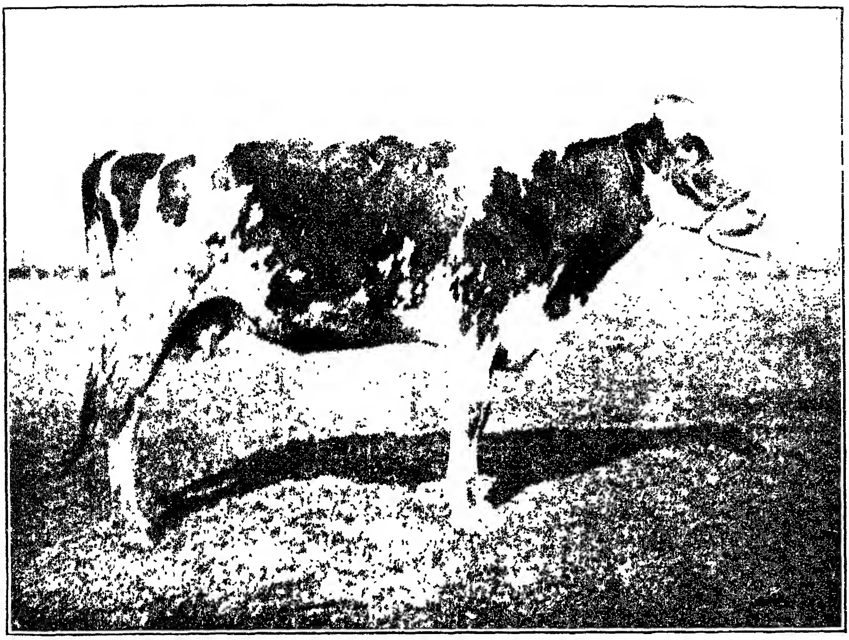

FIG. 1.—A TUBERCULOUS COW OF THE KIND NOT UNCOMMON IN DAIRY HERDS.

[With very few exceptions visibly tuberculous cows scatter enormous numbers of tubercle bacilli, through which their environment, to say nothing of the products from their bodies, becomes dangerous for man and beast.]

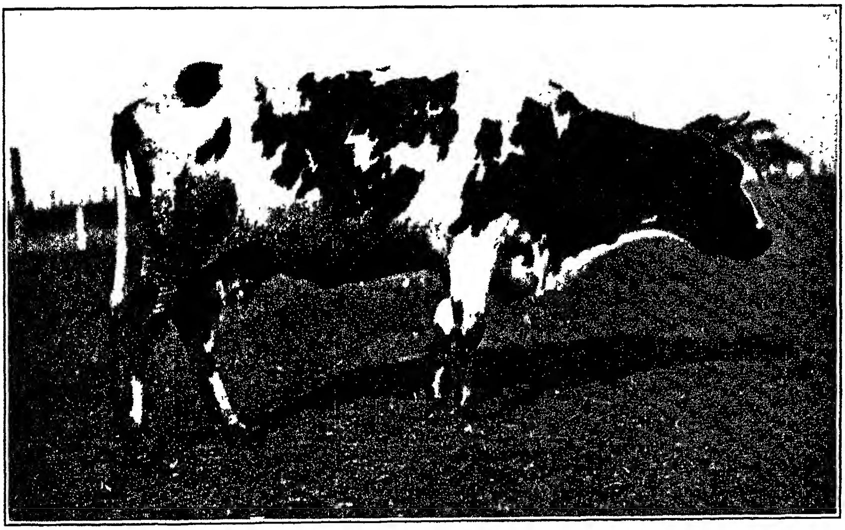

FIG. 2.—A VISIBLY TUBERCULOUS COW.

[As tuberculosis is generally a slow, chronic disease, which gives no external signs of its presence in cattle during its earlier stages, it may reasonably be assumed that visibly tuberculous cows have been affected with tuberculosis and have been dangerous disseminators of tubercle bacilli a long time. The propagation of tuberculosis depends absolutely upon the tubercle bacilli that are expelled by tuberculous animals and persons, and hence no tuberculous cow should remain in the dairy herd until she is visibly diseased, though many do so.]

those who desire to keep a healthy herd free from the disease by avoiding the introduction of tuberculous cows into it, and by those who wish to protect themselves from that exposure to tuberculosis which comes to persons through the use of milk and dairy products derived from tuberculous cows.

EXTERNAL APPEARANCES UNRELIABLE.

How little reliance can be placed on external appearances when we judge the condition of cattle relative to tuberculosis is shown by Plate IV, figure 2; Plate V, and Plate VI. The bull and eight cows represented in these pictures are affected with tuberculosis; the disease has not progressed far enough to encroach dangerously on the factor of safety of an important or vitally necessary organ; hence, there are no determinable symptoms of its presence, though it is definitely known of the bull and five of the cows that they expel tubercle bacilli more or less regularly with the ejecta from their bowels. This information about the expulsion of tubercle bacilli was obtained by making actual, practical, experimental tests, and is not an abstract or theoretical assumption.

The nine cattle shown in the illustrations are in better external condition than the animals in many dairy herds from which milk is regularly sold for use as human food. At the time the photographs were taken the cattle showed no signs indicative of disease and but for the tuberculin test, which first revealed their tuberculous condition, would have passed as sound and healthy animals.

As not all persons are acquainted with the miserable character of the cows from which quite too large a part of the public milk supply is derived, and as it will serve as a means to emphasize by comparison the frequently excellent exterior condition of seemingly healthy but in fact dangerously tuberculous cattle, Plate VII, figure 2, and Plate VIII, figure 1, are presented to show the pitiable and objectionable kind of cows that are only too common in dairy herds. In these illustrations cows are shown that are affected with tuberculosis, and as tuberculous cattle rarely decline much in visible physical condition until they have been affected two years or more, there is little doubt that the subjects of the pictures served the purposes of dairy cows for months and possibly years after they had become dangerous disseminators of tubercle germs.

IMPORTANCE AND RELIABILITY OF THE TUBERCULIN TEST.

We see from the foregoing that the general character of tuberculosis among cattle is that of a long concealed, incipient, slowly progressive, gradually destructive disease, which establishes a superficial toleration for the changes it causes until the factor of safety of some organ or structure of the body has nearly been destroyed. We also see

that tuberculous cattle begin to expel tubercle bacilli in a dangerous way for other animals and public health long before external signs of their diseased condition become apparent. Hence we may conclude that, as tuberculosis is very common among dairy cows, the commonest among the diseases with which they are affected, it is important and desirable to have some means, superior to our bare, unaided, physical powers of observation, to detect tuberculosis in dairy cows while it is still in its earlier, externally concealed stages. The proper use of an efficient tuberculin supplies us with the important and desirable means of detection or diagnosis.

It is not possible in a short article to say much about the tuberculin test for tuberculosis, but the test is of so much importance and so many misstatements have been made about it, by presumably misinformed and inexperienced persons, that a few remarks based on a very large experience may not come amiss.

Tuberculin has been used by the Experiment Station of the Bureau of Animal Industry regularly and continuously during the last sixteen years. Thousands of tests have been made of both tuberculous and nontuberculous animals, and these have been followed so shortly by the slaughter and post-mortem examination of both the reacting and nonreacting animals that the opportunities for discovering the degree to which the test is reliable have been exceptionally numerous and good. The conclusion at the station after this extensive experience is, "Neither the presence nor the absence of any known disease can be determined in any known way with so much certainty as the presence or absence of tuberculosis through the proper use of a reliable tuberculin." The station has tested cattle, hogs, horses, donkeys, goats, sheep, monkeys, and some other kinds of animals, and has injected doses of tuberculin from 50 to 100 times as large as those customarily used for a tuberculin test, and not one of the numerous tests was followed by an injury to a healthy animal.

It is true that tuberculous cows, well advanced in pregnancy, occasionally abort during or shortly after a tuberculin test, but this is not true of healthy cows. It is also true that tuberculin may cause other adverse conditions in tuberculous animals, but healthy cows and healthy animals of other kinds can take anywhere from one to a dozen doses of tuberculin at one time, and probably a hundred or more, without suffering ill effects.

EXTENT OF TUBERCULOSIS AMONG DAIRY CATTLE.

Unfortunately we have no statistics to show precisely what proportion of our dairy cows is affected with tuberculosis, but it has been proven conclusively that the disease exists to some extent among cattle in all portions of the country, fortunately to a less extent

in our country than in most European countries. The available statistics have given rise to the estimate that from 20 to 25 per cent of all our dairy cows are more or less seriously affected. This estimate may be a little too high, but that it is not unreasonable is shown by the fact that slightly less than one-third of 12,721 dairy cattle tested in one of our more densely populated States were found to be tuberculous. The cattle tested belonged to 683 different herds, and it was shown that tuberculosis existed in nearly two-thirds of these herds. In another place the test of 1,538 dairy cows proved that 16.7 per cent were tuberculous.

TUBERCLE BACILLI IN MILK, CREAM, AND BUTTER.

This difference in the relative prevalence of tuberculosis among the dairy cattle of the two localities referred to becomes more interesting and significant when we compare it with the knowledge we have of the frequency with which tubercle bacilli are found, respectively, in the milk derived from the two localities. The milk in the locality where tuberculosis is more common among the dairy cattle contains tubercle bacilli about two and one-half times as often as the milk in the locality where tuberculosis among the dairy cattle is less common. How very commonly live, virulent tubercle bacilli are present in the milk currently sold as human food is shown by the fact that the examination of numerous samples of milk, purchased under ordinary market conditions, in a city that is supplied with milk from the less commonly tuberculous dairy cattle to which we have referred, showed 5½ per cent of all the samples examined to be infected.

We have experimental evidence to prove that tubercle bacilli, when they are present in milk, are transferred to cream, and cream is therefore as dangerous as the milk from tuberculous cattle. We also have experimental evidence to prove that tubercle bacilli when present in cream are transferred to the butter made from it, and that tubercle bacilli may remain alive and virulent in ordinary salted butter longer than five months.

PASTEURIZATION AS A REMEDY.

There is one simple remedy against the danger to which public health is exposed through the use of milk and dairy products derived from tuberculous cows—and all dairy products derived from tuberculous cows are dangerous for public health when they are used in the raw state. The remedy is pasteurization; that is, the exposure of milk, before it is used as a beverage or in the manufacture of butter, cheese, etc., to a low degree of heat for a short period of time. The heat required is from 140° to 150° F., and the time during which this temperature should be maintained is twenty minutes for the lower and ten minutes for the higher temperature. Commercial,

so-called pasteurization, during which milk is heated to a much higher temperature than that above designated for only a fraction of a minute, is not satisfactory. The higher temperature is more apt to change the milk in an undesirable way than the lower, and even the highest temperature to which the name pasteurization can be applied is not effective in a fraction of a minute. Unsatisfactory pasteurization is especially objectionable because it usually causes all the undesirable changes attributed to pasteurization, and which have been used as arguments against this process, and it simply quiets the mind regarding serious dangers it does not remove.

Whenever pasteurized milk is sold it should be clearly designated to what temperature it was elevated, and the length of time the elevation was maintained. The best pasteurization is the lowest effective temperature for the shortest time required to kill tubercle bacilli and other disease germs that are of common occurrence in milk, and this means exposure to 140° F. for twenty minutes. If the temperature used is higher than 140° F. the time of elevation may be relatively shortened, but a temperature higher than a maximum of 150° F. should not be used, and this kills most disease germs in ten minutes.

Cream should be pasteurized before it is used in the manufacture of butter, or should be derived from milk obtained from cows certainly free from tuberculosis.

TUBERCULOUS CATTLE FROM AN ECONOMICAL STANDPOINT.

Though the most important question that arises because of the widespread and common occurrence of tuberculosis among dairy cattle is related to public health, it is by no means the only important question. Tuberculosis among cattle is without doubt the most important question from a strictly economical point of view, entirely apart from consideration for public health, with which animal industry has to deal.

The tuberculous cow, even when she retains the appearance of health, and externally gives the impression that she is a normal animal, is not as efficient or productive or as economical as the healthy cow. The food she eats is partly used to feed the disease that is active in her body; she is the primary and only serious source from which tubercle bacilli that cause tuberculosis in other cattle are scattered; she is responsible for most of the tuberculosis that occurs among hogs, and the alarming increase of frequency with which hogs have been found to be affected with tuberculosis in recent years must be charged to their more common exposure to tuberculous cattle.

It is not difficult for a practical farmer or breeder of animals to reach the conclusion that every particle of disease in the body of an animal causes a proportionate reduction in its efficiency and econom-

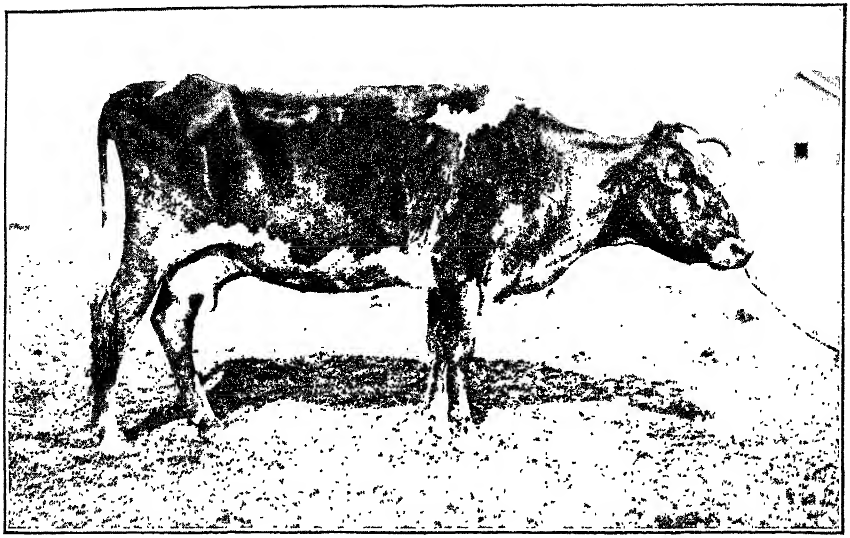

FIG. 1.—A VERY OLD AND VISIBLY TUBERCULOUS DAIRY COW.

[Cows affected with tuberculosis may live, notwithstanding their diseased condition, so many years that their death, when it does come, may be charged with some justice to the infirmities incident to old age. Two cows, very much like the subject of this picture, were kept under observation, after it was positively known that they were tuberculous, for more than six years. This proves conclusively that a cow may live many years after she has become a center for the infection of other animals and a menace to public health.]

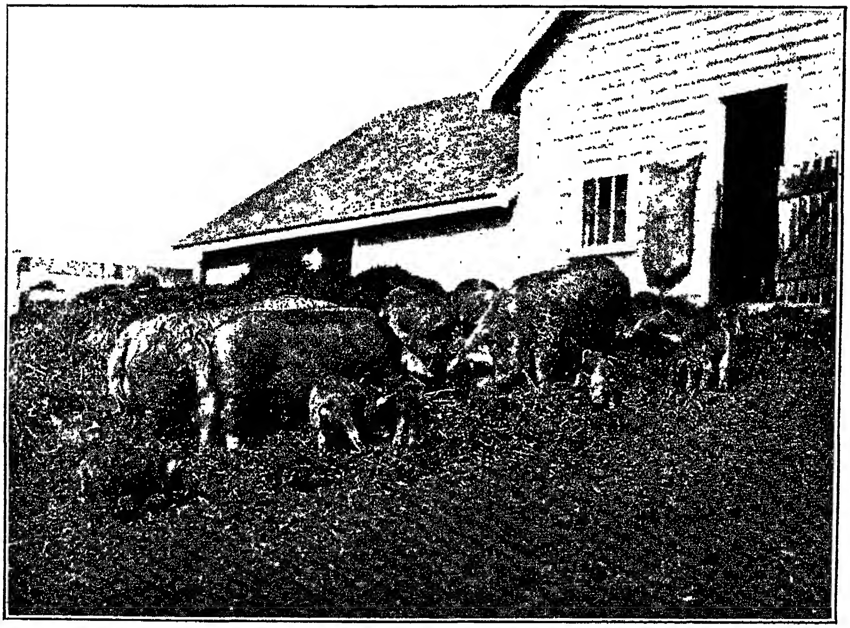

FIG. 2.—HOGS ROOTING IN A MANURE PILE LOCATED IN A HOG YARD ADJACENT TO A COW STABLE.

[Some of the cows confined in the stable are affected with tuberculosis. The cows are not permitted to enter the hog yard and the hogs are not permitted to enter the cow stable. More than half of the hogs that remain in the hog yard six months contract tuberculosis.]

ical value. But while this is true we have no reliable means to determine just how great are the losses among animals that are due to the reduction of their efficiency when they are affected with tuberculosis. In this connection a statement made by a practical dairyman may be of interest. The man in question owned what he sincerely believed to be a herd of healthy cattle; the application of the tuberculin test, however, revealed the fact that a fairly large percentage of his cows were affected with tuberculosis. He immediately disposed of the tuberculous cows, adopted proper measures for the protection of those that were left over, replaced those he lost by others proven to be free from tuberculosis by the tuberculin test, and continued his dairy business. After about five years he asserted that his healthy herd, which he knew to be free from tuberculosis by the periodic application of the tuberculin test, was so much more profitable than the seemingly healthy, tuberculous herd had been, that he had absolutely no reason to regret the expense he had incurred.

The rapidity with which tuberculosis spreads in a herd of cattle upon the introduction of a tuberculous animal varies greatly, but that the spread may be very rapid was demonstrated a few years ago at the Experiment Station of the Bureau of Animal Industry by exposing seven healthy to three tuberculous cattle in a large, well-ventilated stable. At the end of six months the entire seven originally healthy cattle had become infected with the disease. While this rapidity of transmission may be quicker than usual, as a rule it does not take long for the disease, once it is introduced into a herd, to affect a large proportion of the animals. The one fact always to be borne in mind is that the introduction of tuberculous cattle into healthy herds is the real, responsible cause for the increasing prevalence of tuberculosis among dairy cows.

HOW HOGS BECOME AFFECTED.

As to hogs, Plate VIII shows how many become affected with tuberculosis. The picture is a common barnyard scene; a hog yard behind a cow stable, the hogs rooting in the manure from the stable. In this instance the herd of cows confined in the stable was affected with tuberculosis, and fully half of the hogs permitted to root in the manure pile contracted the disease within six months.

As it is known that tuberculous cattle expel tubercle bacilli with the ejecta from their bowels, and that hogs exposed to such infected ejecta contract tuberculosis, it will readily be seen that hogs fed behind cattle, a method practiced quite extensively in some parts of our country, are apt to contract tuberculosis when one or more of the cattle are affected. Hogs also contract tuberculosis from eating the milk of tuberculous cows, and hence, as tuberculosis is very common

among cows, the skim milk returned from creameries may be a dangerous source of infection and should be exposed to a sufficiently high temperature to destroy disease germs before it is given to hogs.

SUMMARY.

The space for this article is limited and therefore a further discussion of the subject at present is impracticable. In conclusion it seems desirable to give a summary of the important facts it has been the intention to briefly illustrate.

(1) The tubercle bacillus is the essential and indispensable cause of tuberculosis. The disease can not occur in persons or animals under any condition unless the tubercle bacillus is present.

(2) The only known source of tubercle bacilli is the bodies of individuals, persons, and animals affected with tuberculosis.

(3) Cattle may be affected with advanced tuberculosis and may expel tubercle bacilli from their bodies in a dangerous way, though they have the appearance of health and show no symptoms of disease.

(4) The tuberculous cow is a serious menace both to public health and to the economic conduct of animal husbandry.

(5) Tuberculous cattle expel the tubercle bacilli that are responsible for the propagation of tuberculosis among cattle and hogs.

(6) The widespread and common prevalence of tuberculosis among dairy cows and the frequently concealed character of the disease make it impossible to be sure that a cow is free from tuberculosis until she has been proven so by the use of the tuberculin test.

(7) The tuberculin test is an efficient and highly satisfactory means for the detection of tuberculosis among cattle.

(8) Tuberculin, when used in ordinary doses or even in doses a number of times as large as those required for a test, does not injure healthy animals.

(9) Tubercle bacilli are more frequently expelled from the bodies of tuberculous cattle with the ejecta from their bowels than in other ways. The importance of this fact is accentuated by another fact referred to in this article, namely, that the practical examination of numerous samples of milk purchased under ordinary market conditions revealed that most commercial milk is to some extent contaminated with minute fragments of vegetable matter identical in appearance with some of the matter passed from the bowels of cattle.

(10) For the protection of public health it seems imperatively necessary that regulations should be made requiring either that all milk must be obtained from cows certainly free from tuberculosis, stabled, milked, pastured, etc., in an environment free from tuberculous infection, or that it must be sterilized or pasteurized before it is used as a beverage or in the manufacture of butter and other dairy products.

COST AND METHODS OF TRANSPORTING MEAT ANIMALS.

By Frank Andrews,

Scientific Assistant, Division of Production and Distribution, Bureau of Statistics.

HISTORIC PERIODS.

The advent of railroads marked a turning point in the growth of the live-stock industry. Scarcely more than a half century ago the carrying trade of the United States was practically limited to passenger traffic and to what is now known as "dead freight." Relatively few live animals were then carried, and even on boats, which were the chief carriers of bulky merchandise, suitable facilities were not provided for live stock. It was generally preferable to drive animals on foot, and this was the prevailing way of taking them to market.

The history of live-stock transportation in the United States since the establishment of railroad traffic may be divided into two periods. A marked characteristic of the first period was the injury caused to stock by lack of proper accommodations and by faulty methods of managing the traffic. The suffering and death of animals on the way and the unhealthy condition of many delivered at their destinations called forth much comment and many efforts for relief during the first few decades of live-stock traffic on railroads. The second period, the present, is characterized by the extension of railroads throughout the range country of the West, and by changes in roadbed, cars, and traffic methods which are continually making the transportation of live stock more humane and economical.

ELEMENTS OF COST.

Of the influences which during the last half century or more have affected the cost of marketing live stock, some of the most important were those relating to their transportation. The cost of transportation, as discussed in this article, includes not only charges for freight, feed, attendance, yardage, and other expenses of the road, but also losses in transit and other items involving more or less directly the expenditure of money, labor, and time in moving meat animals from their native farms or ranges to places of slaughter.

DRIVING AND HAULING.

CONDITIONS IN EARLY DAYS.

Prior to 1850 it was generally the practice to drive live stock to market on foot. At that time, over routes in many portions of the country, pasturage was free and cattle could be grazed along the way

as they were slowly driven to market. One route from the blue-grass region of Kentucky to New York City covered about 800 miles, and, according to a man who drove over it about the year 1847, the time consumed was a few days more than ten weeks. The particular route followed on one occasion by this man led from the neighborhood of Lexington, Ky., to the Ohio River just above Maysville, Ky.; thence northeasterly through Chillicothe; thence across the Ohio River below Wheeling, W. Va. The course then passed through Connellsville and Bedford, Pa., to Carlisle; thence to Harrisburg. Here the road turned southeasterly, passing within sight of Lancaster, through West Chester, to Philadelphia. From this point the cattle were driven northeasterly through Trenton, Princeton, and Newark to the Hudson River and were ferried across to New York City. The drove referred to contained 119 cattle, and three men were required to care for them. Another route from the neighborhood of Lexington, Ky., extended to Charleston, S. C., a distance of 550 to 600 miles. The way led southeasterly through Cumberland Gap to the French Broad River. Then the river was followed as far as Asheville, N. C. The route then turned again southeasterly, crossing the South Carolina line at Saluda Mountain, and thence passed on to Charleston.

In those days driving to eastern seaboard cities from points as far west as Iowa was by no means uncommon, and cattle from Texas were also among those on the road. A news item of 1855 mentions a drove of several hundred cattle from Texas passing through Indiana County, Pa., on the way to New York City. They had left Texas four months previously.

From about 1845 to 1855, and possibly at other times, large numbers of sheep were driven from Vermont into Virginia. A resident of Prince George County, Md., writing in 1854, said that in 1847 he commenced driving Spanish Merinos, mostly from Vermont, to Virginia, and that during the following five years he sold upward of 13,000 head.

Large numbers of hogs also were driven to market before the railroads were built. In 1827 the keeper of a turnpike gate near the Cumberland River certified that 105,517 hogs had during that year been driven through the gate on the way to South Atlantic States.

TRAILS WEST OF THE MISSISSIPPI RIVER.

Among the most important live-stock trails west of the Mississippi River were those which led from Texas. One trail extended to pasture lands in the Kansas River valley on the line of one of the Pacific railroads. Near Abilene, Kans., a station on this railroad, thousands of cattle were wintered annually in the late sixties and early seventies. Another destination of the cattle trails from Texas

was grazing lands along a railroad extending through the Dakotas and Montana. One of the routes from the Southwest to northern pastures over which cattle were driven from 1865 to 1884 led from the Gulf coast of Texas northward, passing west of San Antonio; thence to the Red River at Doan's Store, in Wilbarger County, Tex. Here the trail branched, one part going northward to a point now included in Beaver County, Okla., and thence west to the Colorado ranges. The other fork of the trail led northeasterly through Fort Sill Reservation, now in Oklahoma; thence across the Washita River at Anadarko, Okla.; thence northeasterly to the Canadian River, which was crossed, and the route extended through Fort Reno and Kingfisher, and thence northward, following here the same general route as the present railroad, through Caldwell and Wichita, to the Kansas River just above Abilene.

The increase in farming and the accompanying restriction of the open range, together with the westward extension of the railroads, tended to move the northern terminus of a trail westward. This movement was going on when railroads from the North and East reached southwestern Texas and New Mexico.

The largest number of cattle driven in any one season from the Southwest to northern ranges has been estimated at 416,000 head.[a] This was in 1884, about the time of the opening of a through railroad line over that route, and from that year the number moving over the long trails rapidly diminished.

The valley of a river was often found a convenient course, although not always a direct one, over which to drive sheep from their native ranges to pastures along the railroads which reached eastern markets. One route from Oregon led up the valleys of the Columbia and the Snake rivers, across the mountains of Idaho, and down the valley of the Platte to shipping points in Nebraska.

COST OF TRAILING OR DRIVING.

Cattle driven to Abilene, Kans., from Texas ranges, an average distance of some 700 miles, spent about two months on the trail. It has been estimated[b] that the average cost of bringing cattle over this trail was $2 per head, in addition to a loss of 20 per cent, due to stampeding, stealing, and other misfortunes of the road, making a total of $2.40 per head, or somewhat less than the freight rate over about the same route in 1908.

According to one estimate, the wages and cost of subsistence of eight men engaged in trailing 350 cattle from range to shipping point in 1908 would average $72, or about 20 cents per head. Another

[a] Bureau of Animal Industry, Annual Report, 1887, p. 333.
[b] U. S. Commissioner of Agriculture, Report, 1870, p. 350.

estimate of cost of trailing from range to shipping point for the same year was from 5 to 25 cents per head, including the cost of the round-up but not allowing for losses on the trail.

The trailing of sheep involves relatively less expense. It has been stated that less than half the number of men will be required for a given number of carloads of sheep than for the same number of carloads of cattle The cost of trailing sheep in 1908, not including losses on the way, has been estimated as about $130 per month for a flock of 2,000 to 3,000 sheep, or from one-half to four-fifths of 1 cent per head for a trail of average length.

Over long distances the commercial advantage of the railroad over the trail is well illustrated by the readiness with which the latter is abandoned whenever railroad service is available. One important advantage in favor of the railroad is the saving of time. From southwest Texas to the most remote ranges of the North but a few days' haul now intervenes, while under the old conditions two or three months of trailing were necessary. The decline in the supply of free pasturage and inaccessibility to water along the way over a number of the old routes, due to the settlement of the country, have added much to the difficulty of trailing.

HAULING HOGS IN WAGONS.

Throughout the States where hogs are raised in largest numbers they are usually hauled to shipping points in wagons. In 1906 an estimate of the cost of hauling live hogs to market was made by this Department, based upon data furnished by county correspondents of the Bureau of Statistics. Three hundred and sixteen counties, 291 of which were in the North Central and 25 in the South Central States, reported that the average distance hogs were hauled from farm to shipping point was 7.9 miles and the average time seven-tenths of a day. The average weight of a load was 1,941 pounds, and the average cost was $2 per load, or 10 cents per 100 pounds.

PRIMITIVE TRANSPORT SERVICE.

AN EARLY SHIPMENT.

One of the first shipments of cattle by rail from Kentucky to eastern markets, made in 1852, is described by the shipper as follows: One week was consumed in driving the cattle, 100 in number, from the neighborhood of Lexington, Ky., to Cincinnati. Here they were loaded in box cars and shipped by rail to Cleveland, whence they were taken by steamboat to Buffalo. After a stay of several days at Buffalo, the animals were driven to Canandaigua, N. Y. Thence they were hauled in immigrant cars to Albany, where they were unloaded in the freight house. After spending two days in a feed yard near Albany the stock was taken by boat to New York.

The freight on these cattle from Cincinnati to Buffalo was at the rate of $120 per car, and the total expense from Kentucky to New York was $14 per head.

OLD ROUTES FROM TEXAS.

Among the routes over which cattle were moved from Texas to eastern markets about 1870, three will serve as illustrations. One way led by coastwise steamer to New Orleans, whence the animals were taken northward on river boats. At Cairo, Ill., the railroad journey was begun, northward to Chicago, thence to the East. A second route from Texas was over a trail to shipping points on Red River, whence the cattle were forwarded on steamboats to Cairo, thence to be shipped by rail northward. A third route followed the trails from Texas to feeding grounds along the railroads in Kansas and in regions farther north. From stations along these railroads the animals were forwarded to eastern markets.

RIVER TRADE.

Statistics of the receipts and shipments of meat animals at St. Louis will illustrate the relatively small importance of steamboats as carriers. At St. Louis the total number of cattle received by rail during the three years ending 1867 was 207,000 and the number received by river 65,000. During the three years ending with 1907 the number of cattle received by rail was 3,783,000 and the number by river 46,000. So it appears that in the earlier period, when railroads were just beginning to handle this traffic, they carried more than three times as many cattle into St. Louis as the established river service, and forty years later the cattle traffic by rail was more than eighty times that on the river.

Of the sheep received at this market, the railroads brought twice as many as steamboats in 1865–1867, and forty-five times as many in 1905–1907. River boats carried 18 per cent of the hogs received at St. Louis in 1865–1867 and less than 4 per cent in 1905–1907.

SOURCES OF SUPPLY OF LIVE STOCK.

NUMBER OF MEAT ANIMALS, 1840–1900.

The number of cattle, not including calves, in the United States east of the Mississippi River increased from 14,000,000 in 1840 to 19,000,000 in 1900, but the average per 1,000 population in 1840 was 861 and in 1900 only 349 head. On farms and ranges west of the Mississippi there were 33,000,000 cattle in 1900, an average of 1,584 head per 1,000 population. This average was 2,153 in 1890 and 1,713 in 1880.

The average number of swine per 1,000 inhabitants east of the Mississippi River decreased from 1,496 in 1840 to 556 in 1900. The aver-

age west of this river was 1,540 in 1900 and 1,881 in 1880. The corresponding averages for sheep, excluding lambs, per 1,000 population east of the Mississippi River were 1,162 in 1840 and only 230 in 1900; in the West there were 1,298 sheep per 1,000 population in 1900 and 1,938 in 1880, a decrease of one-third in twenty years.

LOCATION OF RANGE COUNTRY.

Of the relatively large supply of meat animals west of the Mississippi River, a considerable fraction of the cattle and sheep is on ranges. With the development of the country, grazing lands have been more and more restricted by the extension of agriculture. The regions in which permanent grazing lands, or ranges, are to be found are shown on figure 1. These regions include some highly cultivated lands, especially on the Pacific coast and in irrigated sections of the "Great American Desert." The lines between cattle and sheep ranges, also the eastern boundary of the entire range country, are indicated on this map only approximately.

Of the grazing regions in which cattle predominate, the largest extends northward from the mouth of the Rio Grande, with but one interruption, to the Canadian border, and westward for varying distances from a line corresponding roughly with the one-hundredth meridian. A second group of ranges on which cattle are greatly in excess of sheep extends along the Pacific coast from the Mexican border to the Columbia River; while a third group reaches from southern Utah through western and southern Arizona into southern New Mexico. Of the other ranges used chiefly for cattle, one group is located in the southwestern corner of Texas, another is in Wyoming south of Yellowstone National Park, a third touches the eastern shore of Great Salt Lake, and a fourth includes parts of northern Nevada and southern Oregon.

The principal region in which the grazing lands are used chiefly for sheep is shaped roughly like the letter "T," with the top extending westward from central Wyoming to central Washington, and the stem reaching south from Montana to southern Nevada. Two other groups of sheep ranges are in central Montana and central New Mexico, respectively.

Other parts of the range country, as shown on the accompanying map (fig. 1), include grazing lands of both cattle and sheep.

ROUTES AND MARKETS.

IMPORTANT ROUTES.

It has been noted above that the per capita meat supply east of the Mississippi River has been rapidly decreasing and that part of the meat consumed in this region is drawn from the farms and ranges of

the West. For this reason the general tendency is for long-distance shipments of live stock from the West toward the East, even as it was in the earliest days of the western live-stock industry. The old routes from the ranges of the Southwest to northern grazing lands

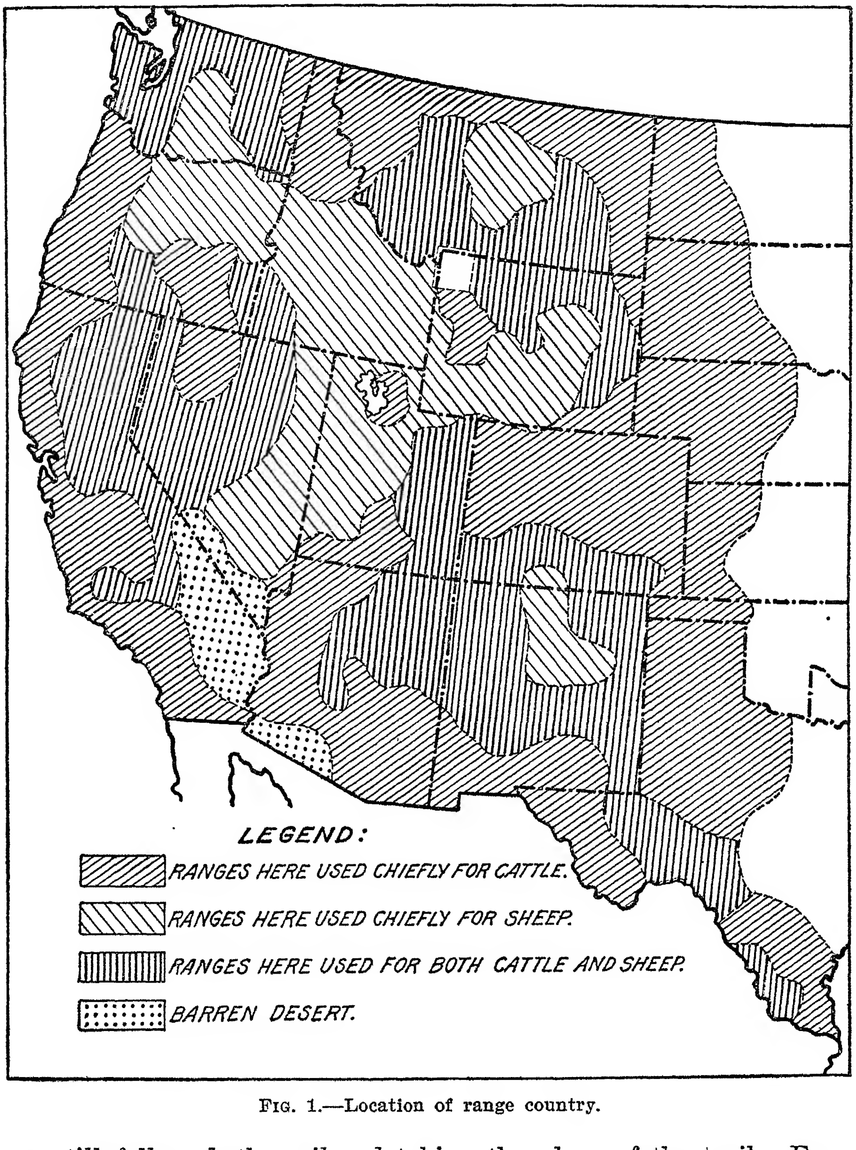

FIG. 1.—Location of range country.

are still followed, the railroad taking the place of the trail. From the big markets along the Missouri River, and also from Chicago and St. Louis, live-stock routes lead to the Atlantic coast, a large number of shipments passing through Cincinnati, Pittsburg, or Buffalo.

In addition to the through routes of live-stock shipments, many lines of local traffic center at each market. The number of animals received at a market from various local shipping points within the radius of a day's hauling is sometimes larger than the number coming over long-distance routes.

ILLUSTRATION OF TRAIN SERVICE.

An example of the complex nature of live-stock movements is furnished by a service consisting of one or more through trains made up at Jackson, Mich., and run to Buffalo via Detroit and Niagara Falls. These are composed of cars from four local trains which come to Jackson from as many different directions. One train leaves Bay City at 10.30 a. m. and is due in Jackson at 6 p. m. the same day; another from Ceresco, about 8 miles east of Battle Creek, is due to arrive half an hour later, having spent five and one-half hours on the way. A third train from Grand Rapids is due at 7 p. m., and the fourth leaves Battle Creek at 10.30 a. m., proceeds southwest as far as Fairfax, then turns northeastward and runs to Jackson, the entire running time being scheduled as eight and one-half hours. The through trains for Buffalo are expected to leave Jackson about 9 p. m., or two hours after the last local is due. The distances traversed by these local trains range from 37 to 115 miles and their average rates of speed, including stops, from 6.8 to 15.8 miles per hour.

SHIPMENTS OF CATTLE AND SHEEP IN TEXAS.

The importance of the local shipments of cattle within the State of Texas is illustrated by figures covering practically all of the railroads of the State for the six months ending May 31, 1908. According to these returns the total number of cattle shipped during those months was about 350,000 head, more than two-fifths of which were consigned to points within the State and less than three-fifths to points beyond. Of the 130,000 to 140,000 sheep received by railroads in Texas during this period, four-fifths were carried beyond the State line.

LIVE-STOCK MOVEMENT AT KANSAS CITY.

An illustration of live-stock movement through a large center is afforded by conditions at one of the chief markets. Of the total number of steers received at the Kansas City Stock Yards in 1907, 59 per cent came from the State of Kansas, 15 from Oklahoma, 11 from Missouri, 6 from Texas, and nearly all the rest from Colorado, New Mexico, and Nebraska. The small part credited to Texas may be explained by the fact that Texas cattle are often sent to pastures and feed lots in Kansas, there to be fattened before shipment to the packing houses.

Of the sheep received at Kansas City, 29 per cent came from Colorado, 22 from Kansas, 10 from Missouri, 9 from Texas, and the rest from a number of other regions. This market was furnished by Kansas with 67 per cent of the hogs received in 1907, by Missouri with 27 per cent, Oklahoma 10, and Nebraska 5.

The destinations of cattle shipped from Kansas City in 1907 were distributed over many States. Missouri received 12 per cent, or more than any other State; Kansas 10, Illinois 5, Iowa 4; a large number of other States received smaller amounts, and 15 per cent was consigned to the various large markets. The number credited to each State does not include shipments to large centers, such as Chicago or St. Louis.

RECEIPTS AT LARGE MARKETS.

At the four largest cattle markets in the United States the average number of cattle received yearly during 1905–1907 was 8,000,000 head, of which the receipts at Chicago were 3,300,000; Kansas City, 2,300,000; St. Louis, 1,300,000; and Omaha, 1,100,000 head. Chicago is the largest market for hogs also, an average of about 8,000,000 head per year having been received there during the three years ending 1907. Markets whose receipts of hogs averaged in these years from 2,000,000 to 4,000,000 head per year included Kansas City, St. Louis, Omaha, and in 1905 Buffalo.

The number of sheep received at Chicago during the three years ending 1907 averaged 4,600,000 per year. Omaha's receipts were next in size, averaging 2,000,000 head; then came Kansas City, with 1,500,000; then, for the two years ending 1906, Buffalo averaged 1,300,000; and New York, 1,100,000.

Receipts of calves were smaller than those of any other class of live stock, the average annual number at Chicago during 1905–1907 being 400,000; at Kansas City, 260,000; at Fort Worth, 230,000; and for 1905–6 at New York, 390,000.

DISPOSITION OF CATTLE AND SHEEP.

A live-stock center serves at least two important purposes: It is a meeting place for dealers, and it is also a place of slaughter on a large scale. The degree to which each of these two functions is developed at a given market is generally shown by the relative number of animals shipped as compared with the number received. A group of markets whose chief business is forwarding cattle includes Denver, St. Paul, Buffalo, and New York, each of which shipped at least 70 per cent of the number received during 1905–6.

Centers whose shipments during this period were less than 70 per cent but more than 50 per cent of the number received included Sioux City, Pittsburg, Philadelphia, Boston, and Baltimore. The largest cattle markets are in the class which slaughter more than

one-half of the number received. Besides Chicago, Kansas City, St. Louis, and Omaha, this third group included, in 1905–1907. Indianapolis, Fort Worth, Louisville, Cincinnati, and St. Joseph.

The important centers which shipped out 50 per cent or more of the sheep received included, in 1905–1907, Louisville, Denver, St. Paul, Cincinnati, Omaha, and, in 1905–6, Pittsburg, Buffalo, Baltimore, and New York. Of the sheep received in 1905–1907 at Kansas City, 71 per cent were retained; at Chicago, 72; at St. Joseph, 74; and at St. Louis, 85 per cent.

RESHIPMENTS OF HOGS RELATIVELY SMALL.

The combined yearly receipts of hogs at thirteen principal markets in the United States averaged 25,000,000 head in 1905–1907, and of this number 20,000,000, or 80 per cent, were retained for slaughter. At St. Louis 73 per cent of the hogs received during this period were slaughtered, at Chicago 77, at Omaha 93, and at Kansas City 96 per cent.

CATTLE EXPORTS.

Most of the meat animals exported from the United States are cattle which are shipped principally through North Atlantic ports. The average number exported yearly from the United States increased from 139,000 during the fiscal years 1878–1882 to 514,000 in 1903–1907, and the exports from the Atlantic coast grew from 90,000 to 354,000 in the same time. During the year ending June 30, 1908, Boston exported 107,000 cattle, New York 76,000, Philadelphia 46,000, Baltimore 30,000, Portland, Me., 22,000, and Detroit 18,000. Exports of sheep and swine from the United States are relatively unimportant, their average value in 1903–1907 being only 4 per cent of the cattle exports.

STOCK YARDS AND FEEDING STATIONS.

FACILITIES.

The facilities for handling live stock at large markets may be illustrated by the capacity of the Union Stock Yards at Chicago. These yards in 1907 covered an area of 500 acres and contained 13,000 inclosures. Separate accommodations, except at unloading and loading platforms, were provided for each kind of stock; sheep and hogs were kept in sheds of two or more stories each, while cattle occupied open pens, each holding from one to several carloads. The inclosures at the loading and unloading platforms each held slightly more than one carload of stock. These yards could hold at one time 75,000 cattle, 125,000 sheep, 300,000 hogs, and 6,000 horses and mules. The movement from one part of the yards to another was facilitated by overhead viaducts and by miles of alleyways among the pens. The water system which supplied the pens had a reservoir holding

10,000,000 gallons and pumps whose daily capacity was 8,000,000 gallons.

In addition to the large stock yards, there are minor feeding stations along the routes from local shipping points to large markets. The area devoted to feeding purposes at these stations varies from small feed yards, where only hay and grain are furnished, to large pastures of 1,000 to 3,000 acres, such as are found at some points west of the Missouri River. Facilities at feeding stations vary greatly. At some places scarcely more than a chute is available, while at others there are platforms and chutes for unloading and loading, pens for feeding and watering, scales, and other appliances for handling the stock.

HANDLING TRAFFIC.

The time and labor required to unload live stock from a train at a stock yard and to place the animals in a convenient location for selling is an element in the cost of transportation. Live-stock trains are so run as to arrive at Chicago or other centers in time for the animals to be fed, watered, and weighed before the morning market opens. On reaching the yards a train is stopped alongside a platform across which are a number of chutes. The distance between the gateways of pens is approximately equal to an average car length, so that each car door on one side of a train may be opposite a gateway, and the stock may be readily moved from the train across the platform and into the pens. As each car is unloaded a record is made of the number of animals as they enter the chutes, and another record is made when they are driven from the unloading pens. These records include also the names of the consignor and consignee, the numbers of cars and chutes, and other data necessary to identify the stock. Each consignment is kept separate as it is driven from the place of unloading along alleyways and over viaducts to the cattle pens, hog houses, or sheep barns, where the animals are fed and watered and where sales take place.

The owner of stock is usually represented in the market by a commission man. Buyers may be divided into at least four classes. One consists of men employed by the local packing houses; another is purchasing for farmers and feeders; a third represents the exporters, and still another class consists of speculators or traders who buy cattle, classify, and sell them to packers, exporters, or feeders. By the middle of the afternoon the market is usually over, and the animals that have been sold for shipment are generally driven to the loading chutes and placed on trains which leave the same afternoon or night. Those purchased by local packing houses are promptly slaughtered.

At Chicago the movement from cars through the chutes and pens to the alleyways beyond is estimated to average for all stock one

minute per carload. This includes counting the animals, making the required records, and waiting in the unloading pen for a place in a procession of consignments moving through the adjoining alleyway. The actual movement from car to chute requires little time, a train of 40 to 50 cars being unloaded easily within fifteen minutes.

CHARGES FOR YARDAGE AND FEED.

Charges at stock yards include two general items: One is the use of the yards, together with the scales, and the other is the feed. In the Middle West a common rate for the first item, or "yardage," is for cattle 25 cents per head, calves 10, hogs 8, and sheep 5 cents. At Buffalo in 1908 "yardage and scale" was for cattle 15 cents, calves 8, hogs 6, and sheep 4 cents. The stock yards in San Francisco grant free use of the yards for twenty-four hours after unloading. After the expiration of this time the charge for each twelve days or fraction thereof for cattle is 25 cents per head, hogs 6, and sheep 5 cents.

The charge for feeding stock in a number of the larger stock yards in 1908 ranged from $1 to $2 per 100 pounds of hay, $1 to $1.50 per bushel of corn, and 60 cents to $1 per bushel of oats.

Minor feeding stations fix rates for hay and grain not greatly differing from those in force at large stock yards. For pasturing sheep en route to the East from Wyoming, Idaho, and Oregon the rates per head at feeding stations ranged in 1908 from 0.5 to 1.5 cents per day.

SHIPPERS OR ATTENDANTS.

In the absence of complete service at some unloading points over a given route it is necessary for attendants or "shippers in charge" to accompany stock trains to assist in unloading, feeding, watering, and reloading the animals; but on through shipments between large centers, such as Chicago and Buffalo, it is not usual for shippers to accompany the stock. In the early days attendants were much more necessary than at present. When cars were overcrowded and the animals thrown down, one of the principal duties of the shipper was to aid them to their feet.

NUMBER OF UNLOADING POINTS ON A GIVEN ROUTE.

Legal requirements are such that thirty-six hours may be taken as the maximum running time between feeding stations. From southern Idaho to Omaha three or four unloading points are usually necessary, one from Omaha to Chicago, and one from that point to Boston or New York. From Chicago to Pittsburg the schedule time of important live-stock trains on two routes, in July, 1908, was twenty-five to twenty-nine hours, and the average rates of speed from 17 to 19 miles per hour, including stops. From Kansas City to Buffalo

via St. Louis and Detroit the time was fifty-six and one-half hours and the average rate about 18 miles per hour. For traffic moving as fast as this, unloading points could be nearly 650 miles apart.

CARRYING CAPACITY OF RAILROADS.

NUMBER OF LIVE-STOCK CARS.

The total number of live-stock cars owned by railroads in the United States in the year ending June 30, 1907, was 69,997. Besides these a considerable number were owned by private car companies. The average capacity of a stock car in 1907 was 29 short tons, and the total for all the stock cars owned by railroads was 2,013,170 tons. This capacity is the weight of dead freight that the car is permitted to carry and not the weight of the live stock that can be comfortably loaded therein.

DOUBLE-DECK CARS.

Double-deck live-stock cars were first used upon railroads in the United States before 1860. The advantage of a double-deck car depends largely upon the size of the individual shipment. When a single consignment of small animals is large enough to load two ordinary single decks, the use of one double-deck car will be a saving to the carrier. Freight rates are frequently lower in double than in single-deck cars.

Of a total of 44,000 live-stock cars owned in June, 1908, by 17 principal live-stock carrying railroads, 7,800, or 18 per cent of the total, were fitted with double decks. If this percentage applied to the total number of stock cars owned by railroads in this country in 1907, there were then about 13,000 double and 57,000 single-deck cars.

AVERAGE CARLOADS.

From reports of stock yards and railroads it is estimated that an average number of meat animals to the carload at Kansas City and Omaha is for cattle about 25, hogs in single-deck cars about 75, and sheep about 120 per deck. Allowing as an average 25 cattle per car, the 57,000 single-deck cars owned by railroads in 1907 would carry at one time 1,425,000 head, and the total weight of these cattle, at 955 pounds per head, would be 680,000 tons, or 41 per cent of the total dead-weight carrying capacity of the cars. If 680,000 tons of dead freight were substituted for the same weight of live stock, only 23,000 instead of 57,000 cars would be required. Taking as an average number of sheep 120 per deck, the 57,000 single and 13,000 double-deck cars would carry at one time 9,960,000 head of sheep, which at an average of 100 pounds per head would weigh 498,000 short tons. The full capacity of these cars being 2,013,000 tons, the equivalent in dead freight to 70,000 carloads of sheep could be carried on 17,000 cars, thus saving 53,000, or 76 per cent, for other service. The 70,000

cars, if loaded with hogs of an average weight of 220 pounds and numbering 75 head per deck, would contain the equivalent of only 24,000 full carloads of dead freight.

RAILROAD FREIGHT CHARGES.

The first railroad freight rates on live stock were quoted in dollars per car, regardless of the weight or number of the animals carried. This method of charge has been blamed for much of the trouble due to crowded cars, but with the establishment of charges depending upon weight, dealers have no longer much inducement to load too many animals in one car. From Chicago to New York, as early as 1879, rates on live stock were quoted in cents per 100 pounds, and nine years later rates from the Missouri River to Chicago and St. Louis were changed in the same way. In 1908 the rates over most of the leading routes east of the Rocky Mountains were quoted in cents per 100 pounds. West of the Rocky Mountains and over routes from the southwestern ranges through Denver northward in 1908 rates were still expressed in dollars per car.

CATTLE IN 1908.

For a large number of shipping points and destinations the principal items of transport cost for cattle from Texas ranges to Chicago via Montana are shown in the statement below.

Principal items in the average cost per head of moving steers from Texas to ranges in Montana, North Dakota, and South Dakota, and thence to Chicago, June, 1908.[a]

Item of cost.	Low.	High.
STOCK CATTLE.		
Trailing (driving) from ranges to local shipping points, Texas	$0.05	$0.25
Freight, Texas to Montana, North Dakota, and South Dakota, at $100 to $137 per car.	2.86	3.91
Feed en route at $2 per car at each of three or four unloading points	.17	.23
Shippers in charge, estimated at $2 per car	.06	.06
Trailing from railroad station to ranges, Montana, North Dakota, and South Dakota.	.05	.25
Total of items given, Texas to Montana, North Dakota, and South Dakota	3.19	4.70
BEEF CATTLE.		
Trailing, ranges to shipping points, Montana, North Dakota, and South Dakota	.05	.25
Freight, Montana, etc., to Chicago, at 35 cents to 66 cents per 100 pounds	3.85	7.26
Feed en route with an assumed average of $2 per car at two to four unloading points	.16	.32
Shippers in charge, estimated at $2 per car	.08	.08
Switching charges, Chicago, at $2 per car	.08	.08
Feed, stock yards, Chicago	.25	.25
Yardage at Chicago	.25	.25
Total, Montana, etc., to Chicago	4.72	8.49
Total, Texas to Chicago via Montana, etc	7.91	13.19

[a] The estimates of cost from Texas to Montana, etc., apply to stock cattle averaging 35 head per 36-foot car, and the estimates of cost from Montana, etc., to Chicago apply to the same cattle after they have attained an average weight of 1,100 pounds each and average 25 head per car.

The average cost per head of shipping steers over a particular route is given by one of the prominent cattlemen of northwestern Texas as follows:

	Per head.
Freight from Texas to Fallon, Mont., $125 per car, 40 head per car	$3.125
Hay, $8 per car	.20
Shipper in charge, $2 per car	.05
Average losses in transit, $5 per car	.125
Total, Texas to Fallon	3.50
Cost Montana to Chicago, including freight, hay, shipper's expense, and yardage	5.90
Total, Texas to Chicago, via Fallon, Mont	9.40

For transporting steers from northwestern Texas to feed lots west of the Missouri River and, after fattening, to London, England, via Chicago, the following estimates are made:

Principal items in the average cost per head of moving steers from Texas to feed lots in Kansas, Colorado, and Oklahoma, and thence to London, England, June, 1908.[a]

Item of cost.	Low.	High.
STOCK CATTLE.		
Trailing, ranges to shipping points in Texas	$0.05	$0.25
Freight, Texas to feed lots in Kansas, etc., at $26 to $78 per 36-foot car	.87	2.60
Feed en route at one to three unloading points, at an assumed average of $2 per car.	.07	.20
Yardage at station near feed lot	.00	.25
Unloading at destination and driving to feed lot	.05	.05
Shippers in charge	.05	.07
Total, Texas range to feed lots in Kansas, etc	1.09	3.42
BEEF CATTLE.		
Driving from feed lot and loading on car	.05	.05
Freight, feed lots in Kansas, etc., to Chicago, at 27 to 55 cents per 100 pounds	3.38	6.88
Feed en route at two or three unloading points; assumed average, $2 per car	.20	.30
Shippers in charge; assumed average, $2 per car	.20	.20
Switching charge, Chicago, at $2 per car	.10	.10
Yardage and feed at Chicago	.50	.50
Total, feed lots in Kansas, etc., to Chicago	4.43	8.03
Freight, New York to Chicago, at 28 cents per 100 pounds	3.50	3.50
Feed en route at one unloading point	.25	.40
Feed at New York	.25	.50
Total, Chicago to New York	4.00	4.40
Ocean freight, New York to London	6.60	7.20
Hay, 14 days, including 3 or 4 days at London	2.50	4.50
Shippers in charge	.50	.60
Total, New York to London	9.60	12.30
Total of items specified, Texas range to London	19.12	28.15

[a] The estimates of cost from Texas to feed lots apply to stock cattle averaging 30 head per 36-foot car; and the estimates of cost from feed lots apply to the same cattle after they have attained an average weight of 1,250 pounds and average 20 head per car.

SHEEP IN 1908.

From Texas and New Mexico to feeding grounds in Colorado and Kansas, thence to Chicago, the total cost of moving sheep, including trailing, freight, feeding, and shippers' wages, averages 50 cents to $1.50 per head; and the additional cost to New York, from 35 to 45 cents per head.

HOGS IN 1908.

The cost of moving live hogs, weighing about 200 pounds each, from farms in Illinois, Indiana, Wisconsin, Missouri, Iowa, Minnesota, and South Dakota to Chicago includes the following items: Hauling in wagons from farm to shipping point, 20 cents per head; freight, from 20 to 70 cents; shippers' wages, feed, yardage, and similar items, 30 to 60 cents; making a total of 70 cents to $1.50 per head.

OCEAN TRANSPORTATION.

LOSSES ON SHIPBOARD.

Since 1891 cattle shipping across the Atlantic from the United States and Canada has been attended with comparatively small loss. In 1892, out of 98,731 cattle shipped to Europe from Montreal, 646, or about seven-tenths of 1 per cent, were lost at sea, and in the following three years the percentages of loss grew less. The number lost in any one voyage was rarely more than three or four.

The rate of insurance in 1908 on cattle shipped from New York to England was quoted at one-fourth of 1 per cent, of which one-tenth of 1 per cent was on account of the risk due to the ship's chance of being lost, and three-twentieths of 1 per cent for the risk of the cattle dying in transit. On this basis it may be assumed that the average loss of cattle on the trans-Atlantic routes is less than 5 in every 2,000 shipped. Prior to the establishment of satisfactory steamship facilities and to the present Government inspection, insurance rates on cattle, according to a prominent New York exporter, varied from 2 to 10 per cent, thus indicating that the losses in those days were from eight to forty times as great as at present.

FREIGHT COSTS FROM THE UNITED STATES.

Ocean freight rates in 1908 from the United States to England were quoted at $6 to $7.20 per head for cattle, and 72 cents (3 shillings) per head for sheep. Twenty years ago, according to an exporter, rates on cattle reached $9.60. The actual rates paid are subject to private contracts, the terms of which are not usually made public. Other items of cost of ocean transportation are attendants' wages and feed for the stock. En route from New York to England the foreman of attendants is paid about $50 or $60 per trip, experienced

hands from $25 to $30, and inexperienced men often no money wages, their passage being earned by work on shipboard. Sometimes, however, the exporter pays at the rate of $3 per man to secure these men through shipping agents. The total cost of labor from New York to London or Liverpool is estimated at 50 or 60 cents per head for cattle and about 10 cents per head for sheep. Enough hay is provided to feed the stock throughout the ten or eleven days on the ocean and for several days at the landing place in England.

RATES FROM ARGENTINA.

Before the United Kingdom prohibited the importation of cattle from the River Plate freight rates from Argentina to England sometimes reached as high as $28.50 per head and as low as $16.80. During the few months in 1903 when the quarantine was suspended in England rates ranged from $18.32 to $22.58 per head.

Unfavorable conditions, sometimes involving serious loss, are reported to have existed on the long voyages from Argentina to England before this traffic was stopped. With improved accommodations, however, many of these difficulties might be overcome, but long voyages necessarily require more food and greater cost for attendance than the short ones from United States ports to London or Liverpool.

ECONOMY IN TRANSPORTING MEAT RATHER THAN LIVE ANIMALS.

RAIL.

It costs the carrier less to transport a given amount of meat than the live animals necessary to produce that meat. Seven carloads of live cattle yield on an average 5 minimum carloads, 20,000 pounds each, of fresh beef, or 2 carloads of 49,000 pounds each. Packing-house products other than fresh meat are carried in still larger loads and the saving to the carrier as compared with live-stock transportation is correspondingly greater.

From Chicago to New York in 1908 the freight and other expenses of the road on an export steer of average weight (1,250 pounds) were $4 to $4.40, while the freight on the average amount of fresh beef yielded by the animal, 700 pounds, would amount to only $3.15, not including the expense of icing. From Kansas City to New York the corresponding difference between live and dead freight is still greater, amounting possibly to $2.25 or $2.50 per head.

OCEAN.

The total cost of shipping a live steer from Chicago to Liverpool, including freight, feed, and attendance, is estimated at $13.60 to $16.70, or considerably more than double the cost of shipping the average weight of fresh beef yielded by the animal.

Over the long voyage from Argentina to England the difference in cost between live cattle and dressed meat would be great. Compared with the freight rates on live cattle, quoted in 1903 when the last exports over this route were made, the cost of shipping fresh meat is small. A rate quoted by a leading steamship company carrying dressed beef from Argentina to England in 1908 was equivalent to $7 for the average quantity yielded by an export steer, or about one-third of the freight and a still smaller fraction of the total transport cost for the live animal, which total included, besides freight, the risks of passing through the Torrid Zone and the expense of feed and attendance for a voyage of more than three weeks.

CONCLUSION.

The growth of economy in the transportation of meat animals has taken place along at least three general lines. One is the saving to the railroads and steamships handling the traffic, which phase of improvement is reflected in lower freight rates. The size and efficiency of cars and vessels have been increased and cheaper methods have been devised for handling traffic in stock yards. A second phase is the reduction of loss in transit, a saving which may be credited to mechanical improvements, to legal regulations, and to the change over a large number of routes whereby the freight charge depends upon the weight of the live stock shipped and not upon the number of cars used. The third direction of this growth of saving is found in the tendency to transport meat instead of live animals. This movement is illustrated by the establishment of new slaughtering centers nearer the sources of supply than are the older meat-packing cities east of the Missouri River.

THE SEARCH FOR NEW LEGUMINOUS FORAGE CROPS.

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NEED FOR NEW LEGUMES.

Leguminous crops play so important a part in agriculture that unusual interest attaches to any new ones, especially if adapted to sections of our country where a satisfactory legume is still a desideratum. The need of satisfactory legumes is greatest at present in our semiarid regions, though a good perennial species adapted to the Cotton Belt would be of incalculable value. If it be true that no system of agriculture can anywhere be permanent without the use of a leguminous plant in rotation, this makes imperative the search for such a crop for every part of our country where agriculture is possible.

Botanists now recognize no less than 10,782 species of leguminous plants, distributed in 487 genera. Of these, 3,846 species in 203 genera are American; 6,930 species in 355 genera belong to the Old World. The Old World thus contains nearly twice as many species as the New. Asia is by far the richest continent both in genera and species. One-fourth of all the species consists of woody plants; the remainder, herbaceous. On each continent the members of this family show a very great range of adaptation to conditions. Many species occur in the coldest of arctic and alpine regions; others in the hottest of the Tropics, and few desert regions are so dry that they can not exist. Indeed, it may be said that wherever other flowering plants exist there occur also legumes.

It would surely seem that in so vast an array of species there must exist some of forage value adapted to every soil and climate where agriculture is possible. When we recall that only about 200 species of legumes are cultivated and only 40 of these as forage crops, the possibility of finding others is very far from hopeless.

AMERICAN LEGUMES AND GRASSES NOT AGGRESSIVE.

It is a striking fact that of the 26 species of legumes more or less cultivated in America only 3 are of New World origin, namely, the common bean, the Lima bean, and the Florida beggarweed. This fact is paralleled with a similar condition among the grasses: Of our 32 cultivated species only 3 are certainly of American origin, and these of but minor importance, namely, slender wheat-grass, rescue grass, and *Paspalum dilatatum*. The last two are from South America and are well adapted only to our warmer States.

It might be assumed from these striking contrasts that native American legumes and grasses had been sadly neglected, but this is far from the case. The evidence is overwhelming that Old World plants as a whole are more aggressive, occupying the land or retaining their hold on it in a way that few American species do. This ability to occupy the land to the exclusion of other plants is a quality of fundamental importance when a crop is sown broadcast, as are most legumes and grasses. Unfortunately the same inherent quality makes numerous Old World plants pernicious weeds, for nearly all of our serious weeds have come from across the seas. If examples are needed one need only recall quack-grass, wild garlic, Canada thistle, ox-eye daisy, field bindweed, orange hawkweed, Johnson grass, sorrel, wild mustard, and wild oats, not to mention about fifty others.

The American Hemisphere has contributed many of the most important plants to agriculture. Indeed it is difficult to imagine agriculture without them. Among them are corn, cotton, tobacco, potatoes, beans, sweet potatoes, tomatoes, cassava, strawberries, peanuts, and pumpkins, but without exception all of these must be so cultivated as to eliminate the competition of weeds. This consideration would tend further to show that the most hopeful source of new forage legumes is the Old World.

CONDITIONS AFFECTING THE SEARCH FOR NEW SPECIES.

Viewing the United States as a whole, it is only the northeastern fourth and the Pacific coast that present considerable similarities in climate to the different parts of Europe. The semiarid regions and the South have qualities of climate that are for the most part absent in Europe. We should, therefore, expect that forage crops of European origin would scarcely be adapted to these regions, which in a large measure has proved true. For these sections our forage crops have come largely from regions of similar climates. It may also be pointed out that there are such pronounced differences in climate between Europe and most parts of America that a number of important European leguminous crops have never been found useful here, or at least only in extremely limited sections; among them are sainfoin, serradella, lupines, horse beans, and sulla.

The importance of these considerations lies in the fact that there are immense regions in the Old World with climates totally different from Europe, but which closely approximate parts of our domain, so that the result of European experience with any such plant is no satisfactory criterion of what it will do in appropriate localities in this country. There are many reasons to make us believe that much of agricultural value will yet come out of these regions. Indeed, it is not too much to say that this is year by year proving to be the case.

COMPARISON OF CLIMATIC CONDITIONS.

When two regions on different hemispheres possess similar climates there is nearly always a similarity in their native vegetation, and it is a demonstrated fact that many of the plants native to one of the regions find themselves perfectly at home in the other. California conditions are markedly similar to those of the Mediterranean region, so that it is no surprise to find more than fifty plants from the latter region that thrive in California with marvelous vigor. It is conservatively estimated that over 75 per cent of the forage on the California range lands is made up of Mediterranean immigrants, mostly annuals, such as wild oats, bur clover, alfilerilla, bromegrasses, fescues, wild barleys, and many others.

The Great Basin and the Columbia Basin resemble California in one marked respect, namely, that the summers are dry and the winters wet. Indeed, the principal difference from California lies in the colder winters. The difference has not prevented the introduction and rapid spread of most of the European annuals now so conspicuous in California. It is really little short of amazing how rapidly and extensively some of these plants have occupied the range lands at the expense of the native vegetation.

The conditions in Arizona are not very favorable to the plants that have found California conditions so congenial, with the exception of alfilerilla. Arabia of all Old World regions is most like Arizona, and from there if anywhere we should expect plants adapted to Arizona conditions.

Western Washington and western Oregon closely approximate in climate the British Isles, and practically everything that thrives in the one region is at home in the other.

The Middle and South Atlantic States are similar to Japan and China in climate. It has long been recognized that all Japanese plants, especially ornamentals, thrive in this region perfectly. A number of them are so at home, indeed, that they have literally taken to the woods and behave as natives; witness the Japanese honeysuckle, Japan clover, ailanthus, Paulownia, and the recently introduced Chinese violet.

The cotton States evidently have much in common with India and southeastern Asia, whence we have obtained cowpeas, crab-grass, Bermuda grass, velvet beans, and many weeds, and to a less degree with Argentina, where rescue grass, carpet grass, paspalum grass, and a number of common southern weeds are native.

Of late years there has been increasing evidence that the high plains of northern Texas resemble the highlands of India. At least practically every plant introduced from the India highlands has succeeded better in the Texas Panhandle than elsewhere in the United States.

The Great Plains region lying east of the Rocky Mountains and west of the one hundredth meridian finds its nearest parallel in climate in Asia, whence we are most likely to obtain better forage crops resistant to cold or drought, or both. The task is far from easy, as very few of the native forage plants of central Asia have ever been grown under cultivation even in their native land. This is the region that gave us alfalfa, so we have good reason to expect that other valuable forage plants will be found there.

POSSIBILITIES NOT LIMITED.

It must not be forgotten that over much of the regions referred to forage crops, as such, have scarcely been grown. Where the population is dense, domestic animals have been fed largely on the refuse of plants grown for human food. Until they were grown in this country agriculturists were acquainted with cowpeas, soy beans, sorghums, and millets principally as crops for human consumption. In this country they have all become important, but mainly as forage crops. In the parts of Asia where the population is sparse, animals are fed almost wholly on native meadows and pastures, so that the value of these forage plants under cultivation yet remains largely to be determined.

Broadly speaking, the search for legumes fitted to the semiarid States must be in similar regions in Asia and, perhaps, northern Africa; and for those suited to our Southern States the search must be made in India, China, and, to a less degree, South Africa. In all of these regions there yet remain hosts of legumes to be tested agriculturally. The possibilities are by no means confined to obtaining new species, as the results of recent years' work have disclosed the existence of numerous varieties of such old crops as alfalfa, clover, soy beans, cowpeas, velvet beans, bur clovers, vetches, and others which have been for the most part heretofore unknown in this country. A number of these have already proved to be distinct acquisitions to American agriculture.

During the past ten years the Department of Agriculture has tested no less than 187 species and 800 varieties of legumes as forage, mostly new things obtained by the Office of Foreign Seed and Plant Introduction. This was not merely a miscellaneous lot of species gathered as a collection, but there was definite reason to believe that each might prove of value. Out of these only a small proportion has proved to be useful or promising to American agriculture. The more important are discussed in the following pages.

THE LYON BEAN.

One of the very important legumes for Florida and the sandy soils of the South Atlantic and Gulf coasts is the Florida velvet bean, which has been known in Florida for more than fifty years. The

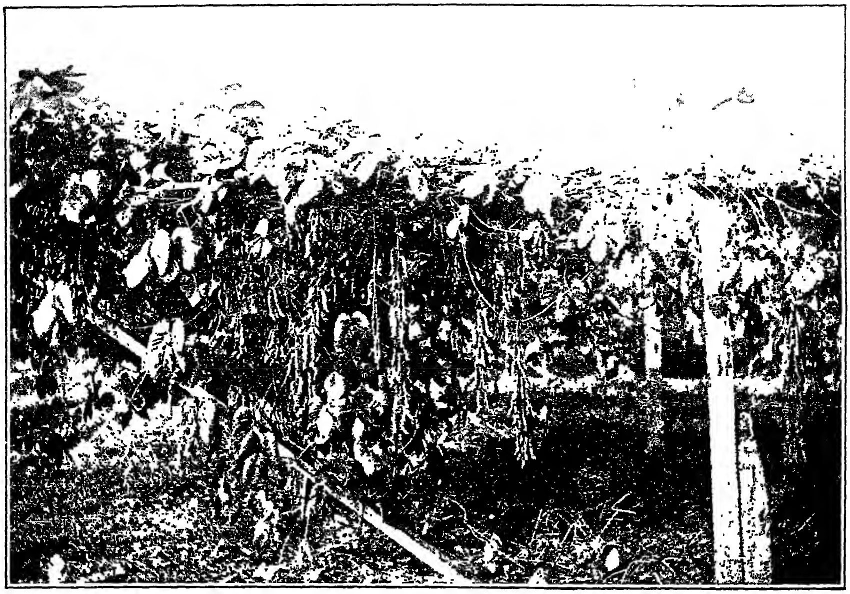


FIG. 1.—LYON BEAN (MUCUNA LYONI) GROWING ON A TRELLIS AT BILOXI, MISS., IN 1908.

[The clusters of pods are from 2 to 4 feet long.]

FIG. 2.—A PATCH OF KUDZU (PUERARIA THUNBERGIANA) GROWING AT WASHINGTON, D. C.

[These plants were cut down to the ground in the spring and the illustration represents the growth of a single season. The mass is about 5 feet high.]

FIG. 1.—FIELD OF BRABHAM COWPEAS GROWN AT ROGERSVILLE, TENN., IN 1908.

[Note the great abundance of pods.]

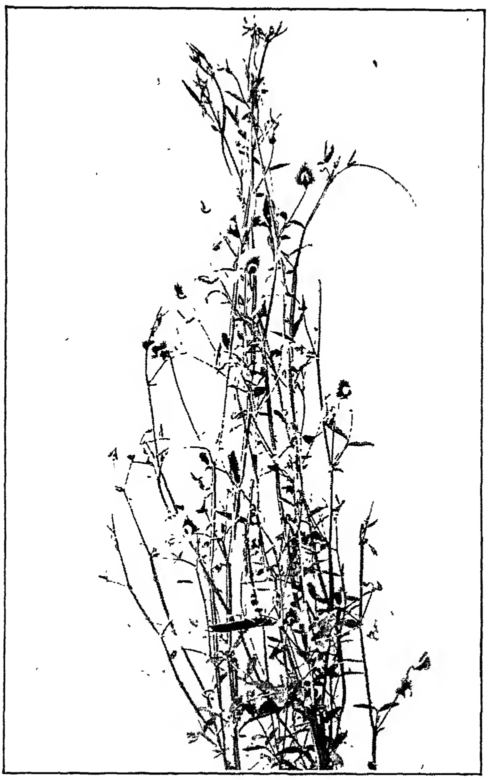


FIG. 2.—THE TOP PORTION OF A SINGLE TANGIER PEA PLANT (LATHYRUS TINGITANUS) WHICH GREW TO A HEIGHT OF 9 FEET.

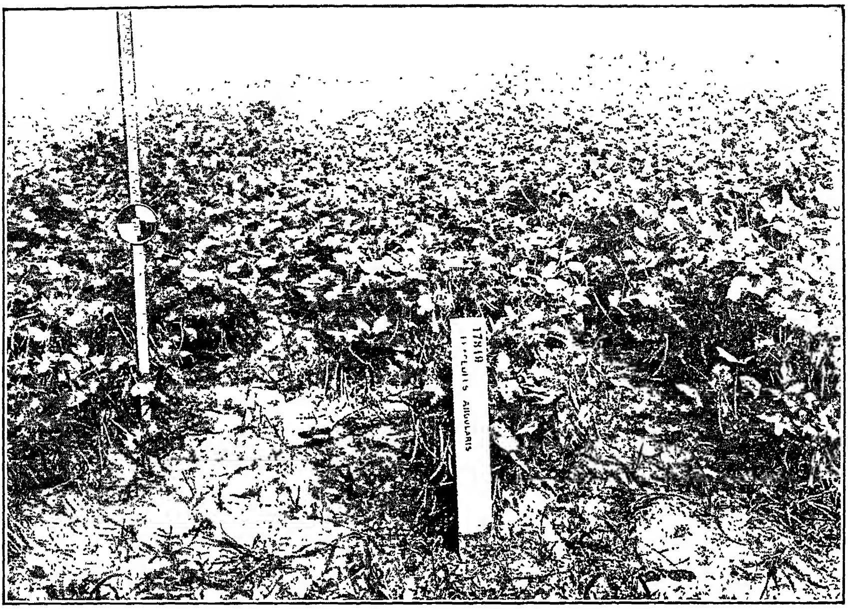


FIG. 1.—FIELD OF ADZUKI BEANS (PHASEOLUS ANGULARIS) GROWN AT ARLINGTON FARM, VIRGINIA, IN 1908.

[Yield of seed, 26.4 bushels per acre.]

FIG. 2.—FIELD OF ADZUKI BEANS (PHASEOLUS ANGULARIS) GROWN AT ARLINGTON FARM, VIRGINIA, IN 1908.

[Yield of seed, 27.3 bushels per acre.]

FIG. 1.—BONAVIST (DOLICHOS LABLAB) GROWING WITH CORN AT ARLINGTON FARM, VIRGINIA, IN 1907.

FIG. 2.—BONAVIST (DOLICHOS LABLAB) GROWING WITH CORN AT ARLINGTON FARM, VIRGINIA, IN 1908.

[The corn was beaten down by a storm, so that the field is almost entirely bonavist.]

original source of this bean is unknown, and it has never been obtained through any foreign source, notwithstanding that a good deal of this seed was long ago distributed throughout the world by the Department of Agriculture and others. During the past two years an active search was made to obtain other species of Stizolobium to test in comparison with the Florida velvet bean, and there have been secured from various sources, principally southeastern Asia, no less than eight distinct varieties or closely related species. Three of these have been grown in comparison with the Florida bean at many different places; the remainder at but a few places, owing to the small amount of seed. The Florida velvet bean is used primarily as a pasture plant, cattle being turned into the fields late in the season when the crop of pods is mature or nearly mature.

Other things being equal, the best species or variety would be that which produces the largest amount of pods and seed. In this respect the Lyon bean (*Stizolobium lyoni*) has thus far proved to be superior to the Florida velvet bean. This species was described from the Philippine Islands, and 1 pound of the seed was received in 1907 from Mr. W. S. Lyon, of Manila, who discovered the plant. From the Florida velvet bean this plant is distinguished by having rather broader leaflets, in which the surface is not plane, but more or less billowy; by having white instead of purple flowers; by having the pods covered with short, white, appressed hairs, instead of the black velvety hairs of the Florida bean; and by having the seeds white and much more compressed than those of the Florida bean. The important points, however, from an agronomic point of view are that this bean is somewhat earlier and produces much more seed. Judging by its behavior during the past two seasons, this species is quite certain to replace the Florida velvet bean as a forage crop. As it is hardly proper to call this a velvet bean, the name "Lyon bean" has been adopted. (See Pl. IX, fig. 1.)

In this connection it may be interesting to note that two other varieties of Stizolobium, S. P. I. No. 21952, from Buitenzorg, Java, and S. P. I. No. 22463, from Saharanpur, India, have white seeds, very much like the Lyon bean, but in each case there is a small dark spot at one end, and both have purple flowers. Neither of these species is nearly equal to the Lyon bean as a forage crop, notwithstanding the close similarity of the seeds.

KUDZU.

Kudzu (*Pueraria thunbergiana*, Pl. IX, fig. 2) is a large-leaved, woody, leguminous vine, native of Japan. For many years it has been more or less grown in the United States as an arbor plant, for which its extremely rapid growth, dense leafiness, and attractive foliage well fit it. Its limited horticultural use has indicated that it is hardy as far

north as Nova Scotia and that it also succeeds admirably in Florida. It is not drought resistant and therefore is adapted mainly to the more humid States. Mr. David Fairchild reports that in Japan it is allowed to grow mostly on rough land or cliffs which do not permit of cultivation. The herbage is there gathered and used as green feed for cows.

The Japanese also utilize the plant in other ways. From the thick roots is extracted a starch of unusually fine quality that is used principally for confectionery. The fiber of the stems is also used in making a sort of cloth of coarse texture for wrapping purposes, some of which is imported into this country under the name "grass cloth."

The kudzu is an extremely vigorous grower, well-established plants growing numerous running branches to the length of 40 feet a season at Washington, D. C., and 75 feet in Florida. These branches root readily at the joints, especially where they are covered with a little soil. In this way additional plants can very easily be obtained.

So far as is known, the kudzu has never ripened seed in this country, although it blooms in Florida. Seed, however, is obtainable from Japan. When grown from seed the plant the first year makes prostrate branches 6 to 12 feet long, and during the second season the growth is much greater. It is not until after the second season that the plant is strong enough to make anything like its maximum growth. While Mr. Fairchild suggested, as long ago as 1902, the advisability of testing kudzu as a forage plant in waste places, this does not seem to have been done until recently, when several investigators reported results.

Samples of kudzu hay from Florida were exhibited at the Jamestown Exposition in 1907. One Florida experimenter states that kudzu makes at least double the growth of the Florida velvet bean, and that the hay is much more easily cured. Cattle eat the green leaves readily. When cut and cured for hay, horses are fond of it. While if grown on level ground it is possible to cut the kudzu for hay, it seems altogether likely that its value will be primarily as a permanent pasture plant, especially on lands too rough or too poor to till.

Judging from the growth of the plant at many places, it would seem to be entirely practicable and profitable to plant it in two or more pasture fields, grazing in rotation. Where such plantings are made, the plants should be set out at intervals of 15 or 20 feet each way. Where seed is used it will be advisable to start the plants in a bed and then transplant them when they have attained sufficient growth. From a single plant any number of rooted cuttings can easily be obtained by layering. If the land is brushy that is really an advantage, as kudzu grows better when supported above the ground.

In a number of parts of the country stock raisers have become very much interested in the possibility of utilizing this plant on poor or rocky land, and numerous experimental tests are under way. It would seem to be the part of wisdom for anyone in experimenting with this to confine his first test to a small area. It is very doubtful, indeed, whether land that can be profitably tilled should be planted with this vine, as on account of the large woody roots it would be somewhat expensive to remove in case it were not found altogether desirable. No data are at hand regarding the yield per acre of starch from the roots, and it is problematical whether the yield of roots and of fiber would pay for clearing the land.

GUAR.

Guar (*Cyamopsis tetragonoloba*) is an East Indian annual legume, the seed of which was first obtained by the Department of Agriculture in 1903. It is very different in appearance from any other legume grown in this country. From an agricultural standpoint it is especially promising on account of its great drought resistance and prolific seed yield. With sufficient moisture it grows to a height of 5 or 6 feet, but under arid conditions only 3 to 4 feet. It is the most drought-resistant annual legume yet obtained. At Chico, Cal., a fine crop was produced without irrigation and without a drop of rain from the time it was planted until nearly mature. During the whole season it showed no suffering from the drought, which seriously affected adjoining plots of Kafir corn and of sorghum. In Texas it has also demonstrated its high drought resistance.

In India the plant is grown both for green forage and for the seed, which, according to Duthie, is used mainly to fatten cattle. The seeds are somewhat pungent in taste, but highly nutritious, containing over 32 per cent of protein. Some Hindu tribes also use the green pods as a vegetable after the manner of string beans.

Guar is very prolific, a single plant grown at Chico producing 260 pods. The yield in India is stated to be about 13 bushels per acre. Small plots in this country have shown a considerably greater yield, as the rather crude methods of Hindu agriculture would lead us to expect. Owing to the upright habit of the plant and to the fact that the ripe pods are broken open only with difficulty, guar can readily be harvested with a binder and thrashed.

There are many varieties, some of them with single stems; others branched from the base. The upright-growing varieties are preferable, at least from a seed-producing standpoint. Some of the varieties have much larger seeds than others, and on this account are more desirable.

In regard to its palatability to live stock, the evidence is thus far somewhat conflicting. At the Oklahoma experiment station the cattle ate the straw readily after the seeds had been thrashed out,

notwithstanding that it was decidedly coarse and the leaves had fallen. Most experimenters report that their mules and cows eat it as well as cowpeas. Mr. G. A. Schattenberg, of Boerne, Tex., found that his sheep ate it readily, and he regards it as an exceedingly valuable plant for pasture. A few experimenters have had less satisfactory experiences, in some cases the animals absolutely refusing to eat it. The mixed results would lead to the belief that most animals will acquire a taste for it, as animals commonly refuse a new forage at first. Its use in India certainly confirms this idea.

Guar requires a long season and considerable heat to mature. It is likely that it will prove valuable in dry farming in the southwestern portion of the United States, especially where it is too dry for any other legume to succeed. It is practically certain that the cowpea is to be preferred wherever it will grow, but the guar is very much more drought resistant.

TANGIER PEA.

The Tangier pea (*Lathyrus tingitanus*, Pl. X, fig. 2) is a native of North Africa. In a general way it resembles the garden sweet pea and has been grown to a slight extent as an ornamental for more than one hundred years. As a forage crop it was first cultivated by Dr. L. Trabut in Algeria with very gratifying results. It has been extensively tried in this country in the Pacific States and in the South in comparison with common vetch, which, under favorable conditions, it far outyields. Some fear has been expressed that this plant might prove harmful to stock, as a number of species of Lathyrus are considered poisonous, at least under certain circumstances. Doctor Trabut, however, has never experienced ill results in feeding it, and in a number of places in this country it has been fed quite largely with only favorable results. The Tangier pea has been found not well adapted to the drier portions of the Plains region. As a crop its final place in American agriculture will depend upon its ability to compete with vetch, but it is doubtful whether the seed can ever be raised as cheaply as that of common vetch.

SIBERIAN ALFALFA.

The explorations of Prof. N. E. Hansen in Siberia have brought into prominence the yellow-flowered alfalfas native to that region and which flourish under excessively severe conditions of cold and drought. From the similarity of this region to that of western Montana and the Dakotas it was only reasonable to believe that these alfalfas would prove to be well adapted to those States, which the tests as far as conducted verify. Unfortunately, these yellow-flowered alfalfas do not have so upright a habit as ordinary alfalfa. Some recent critical studies, however, have proved beyond doubt that several hardy strains of alfalfa differing but little in appearance from

ordinary alfalfa owe their hardiness to the fact that they are hybrids between ordinary alfalfa and one of the yellow-flowered alfalfas. This fact is of great interest and importance, as undoubtedly breeders will develop by similar hybridizations superior hardy alfalfas adapted to our coldest and driest States. Thus far the hybrids obtained are all the result of crossing *Medicago sativa* with *M. falcata*, but in Siberia there are at least two other yellow-flowered species, *Medicago ruthenica* and *M. platycarpa*, both of which possess desirable qualities and which have recently been obtained by Professor Hansen. It is not too much to hope that hybrids with these species will result in varieties of additional value. This is one of the most hopeful lines of inquiry in the search for better legumes adapted to our cold and arid States.

MOTH BEAN.

The moth bean (*Phaseolus aconitifolius*) is an annual legume, native of India, where it is grown principally for its seeds, which are used as human food. In habit it forms mats 2 to 3 feet in diameter and 12 to 18 inches high, with very numerous viny branches, the lower ones lying prostrate on the ground. This bean has proved to be exceedingly well adapted to the conditions in the Texas Panhandle, where in many ways it is superior to the cowpea. The prostrate habit and immense amount of foliage enable it to cover the ground so completely that there is practically no evaporation of water from the soil. The very viny branches and the persistency with which the leaves are held make an unusually fine quality of hay, which stock of all kinds eat greedily. No difficulty has been found in mowing this plant if cultivated in rows, as is usually necessary in semiarid regions, and the mower is started under the first plant.

The yield per acre during the three years in which it has been under trial averages about 2 tons, fully equal to that of the cowpea and superior in quality. Under favorable conditions the pods are produced in large numbers and show no tendency to shatter. The roots are remarkably well provided with tubercles, indicating that the plant is a very efficient nitrogen gatherer. So far as can be ascertained in limited experience with it, it is somewhat more drought resistant than the cowpea, with which crop it will necessarily compete agriculturally. It seems reasonably certain that this plant will become of considerable use in southwestern Kansas, western Oklahoma, and the Panhandle of Texas. Where the rainfall is greater comparative experiments indicate that the cowpea is distinctively preferable.

ADZUKI BEAN.

The adzuki bean (*Phaseolus angularis*, Pl. XI) is a native of southeastern Asia, being largely grown for human food in China and

Japan, and to a less extent in India. The plant is erect growing, leafy, and strictly "bunch" in habit, growing 1 to 3 feet in height according to variety and soil. It possesses root tubercles in great numbers and is probably very efficient as a nitrogen gatherer. The numerous varieties are distinguished most markedly by their different times of maturity and by the color of the seeds, which may be yellow, brown, red, gray, or variously mottled. For several years this plant has been tested as a hay plant, but it does not possess sufficient ability to fight weeds to enable it to compete with the cowpea. When grown in cultivated rows, however, it has produced very heavy crops of seed, up to 40 bushels per acre on the relatively poor soils of the Arlington Experimental Farm, a yield that is not exceeded even by the soy bean. It is somewhat doubtful whether this bean will become popular in this country as human food. On account of the high yield of grain per acre it will doubtless become valuable as stock feed, as no other legume, with the exception of the soy bean, will yield larger seed crops.

COWPEA.

The cowpea (Pl. X, fig. 1; Pl. XIV) has for nearly one hundred years been the chief leguminous crop in the Southern States, and there has been a constantly growing appreciation of its value. Over forty varieties have been more or less cultivated in the United States, all belonging to the species *Vigna unguiculata*. It is quite likely that many of these varieties originated in America by hybridization or by mutation. The cowpea, together with the closely related catjang (*Vigna catjang*) and the asparagus bean (*Vigna sesquipedalis*), has been cultivated since ancient times, especially in southern Asia and Africa, as human food. From these regions a very large number of varieties unknown in this country have been obtained in recent years. Very few of these have points of superiority not possessed by our best cowpeas, except certain upright-growing varieties of catjang. These varieties are exceedingly vigorous, very late, not subject to disease, and hold their leaves perfectly. The seeds are small and hard, and retain their vitality much longer than the larger-seeded cowpeas. Furthermore, on account of their hardness these seeds exhibit a pronounced resistance to the attack of weevils, a matter of great importance. Mr. George W. Oliver has made numerous hybrids between some of the catjang varieties and the best American cowpeas, in which are combined the desirable qualities of both. It now seems practically certain that some of these hybrids will prove distinctly superior to any cowpeas that we now possess.

THE BRABHAM COWPEA.

Of late years breeders have been actively engaged in developing improved varieties of the cowpea, and from time to time have ap-

peared new varieties arising through accidental hybridization. One of these is the Brabham cowpea, a hybrid between the Iron and a half Crowder form of Whippoorwill, which originated spontaneously on the farm of Mr. A. W. Brabham, at Olar, S. C. Mr. Brabham first obtained this hybrid in 1902 by planting the Iron and the Whippoorwill Crowder, locally called "Shinney," in alternate hills. The Iron was planted eight days earlier so as to bring the two in bloom together. There can be little question as to the Brabham being a hybrid of the two supposed parents, though natural hybrids of the cowpea are far from common.

A small packet of seed was first obtained by the Department of Agriculture in 1907, and in a preliminary row test the Brabham showed up remarkably well, being of excellent habit and most prolific. On account of its showing, a few bushels of seed were obtained from Mr. Brabham, which were tested in 1908 at Arlington, Va., Louisville, Ga., Rogersville and Knoxville, Tenn., Auburn, Ala., Monetta, S. C., and Chillicothe, Tex. At Monetta it was found to be perfectly resistant to wilt and to root-knot, and when grown alongside of the Iron proved to be 15 or 20 per cent better than its parent. Where grown for hay, the Brabham plants were fully 4 inches taller than those of the Iron, and in a comparative test for seed yield the former was distinctly superior, the yield per acre being 21.7 bushels against 15 bushels of Iron. As the Brabham pea is somewhat smaller than the Iron, this difference is very much more in its favor than appears on the surface. At Auburn, Ala., Louisville, Ga., and Chillicothe, Tex., the Brabham pea made the same excellent showing. The fields at Knoxville and Rogersville, Tenn., likewise showed a most excellent yield of pods, but the plants here showed a tendency to continue growth at the top, forming viny tips 4 inches to a foot in length. At Arlington, Va., and Springfield, Md., this tendency was still more pronounced, the great growth of viny tip materially cutting down the seed crop. This habit did not appear in the pea during 1907 and may be due to the season. From the fact, however, that the same characteristics showed in Maryland and Virginia and in two plantings in Tennessee it would seem to be an inherent character of the variety. If this is the case, the variety will be of prime importance only on the sandy coastal lands from North Carolina southward. The variety is considered promising enough to justify the distribution of it throughout the Southern States. Its mode of growth is such that it can be easily harvested with a mower without losing any of the pods, which will also help to make it popular.

Plate XV shows the seed of the Brabham cowpea and the seeds of its two parents. It will be noted that the seed of the Brabham is somewhat smaller than that of the Iron, but of the same shape, and has the markings of the Whippoorwill variety.

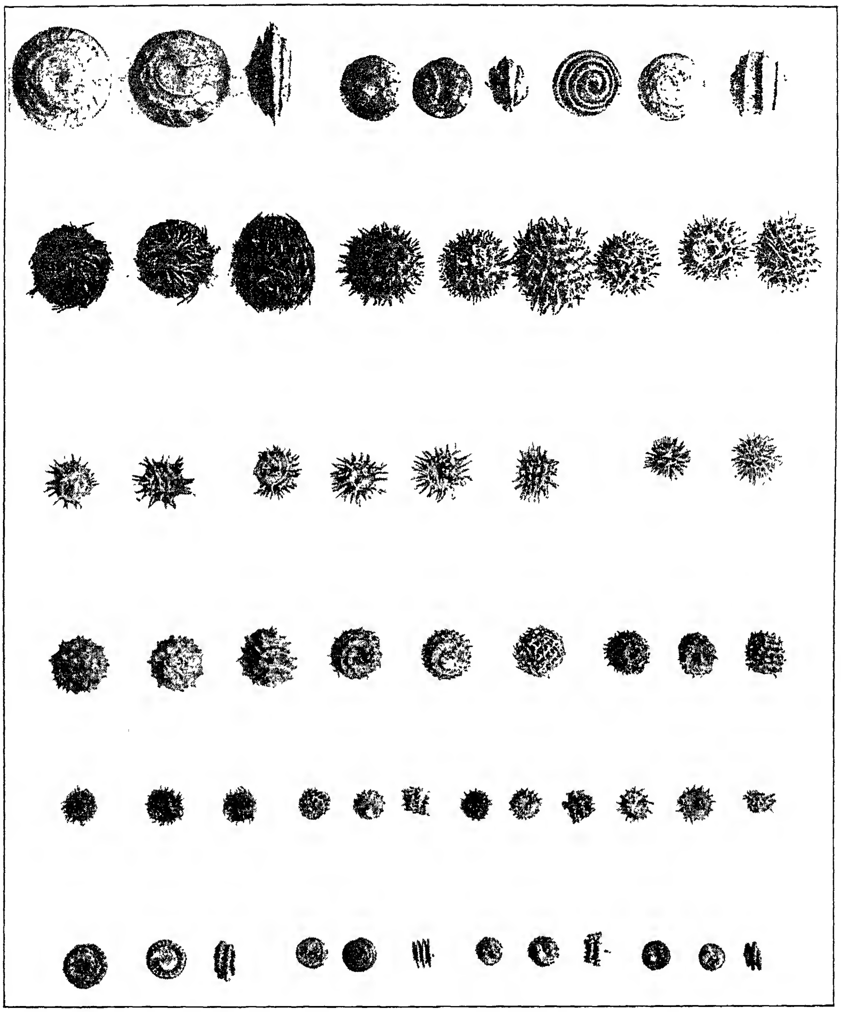
THE GROIT COWPEA.

The Groit cowpea is a hybrid between the New Era and the Whippoorwill, and likewise probably originated spontaneously. The first seed was obtained by the Department of Agriculture in 1903, and was grown by Mr. F. C. Little, of Louisville, Ga., who had not noticed that it was different from the New Era. The seed was also obtained in April, 1904, from Richmond, Va., but the original source of this seed we have been unable to trace. It was also grown by the Arkansas experiment station in May, 1904. It is possible that all these lots of seed were of the same origin, but it has not been possible to determine this positively. That this cowpea is a cross between the New Era and the Whippoorwill is rendered certain from the fact that Mr. George W. Oliver has created this variety anew by crossing the New Era and the Whippoorwill. Until 1906 this variety was confused with the New Era and distinct characters had not been noted. It was grown at the Missouri experiment station in 1905 and 1906 under the name of Groite, and the following notes were published concerning it:

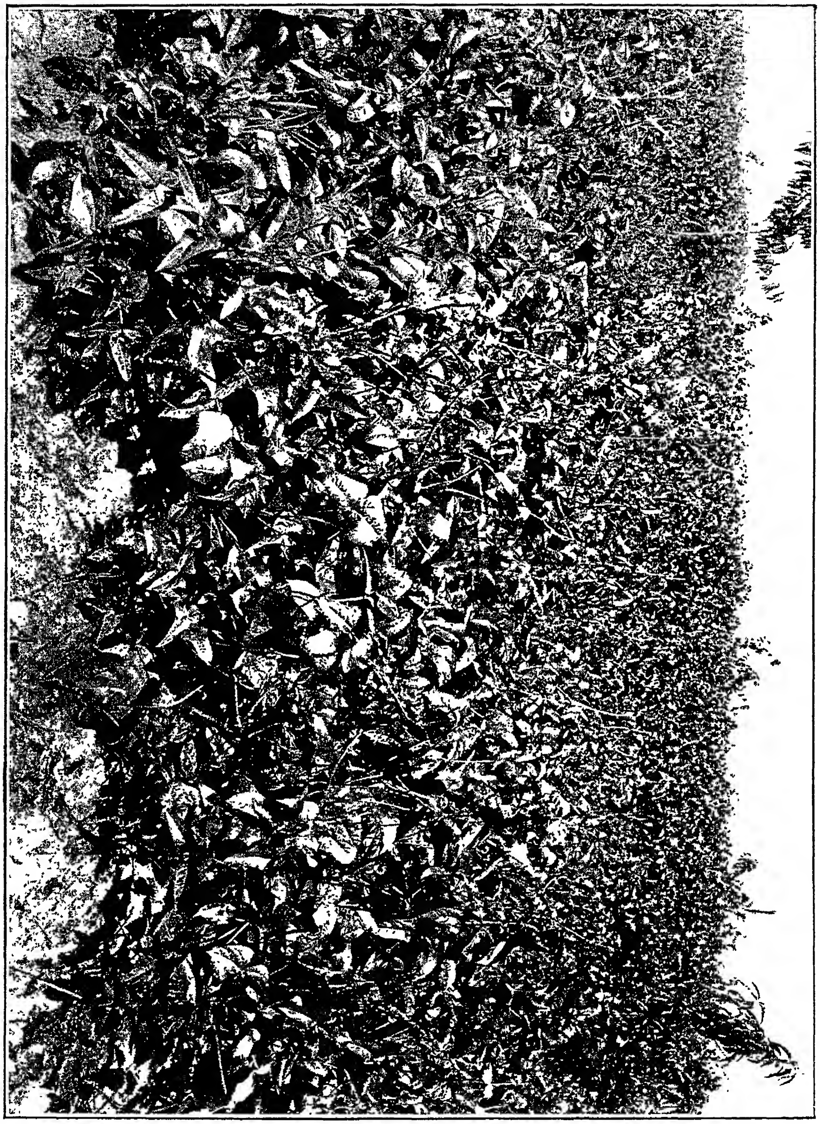
> It is difficult to determine whether or not the New Era and Groite are the same variety, as in the habit of growth, the form of vine, and the color of seed, they are nearly identical in the two varieties.

It is especially interesting that in the test of fourteen varieties at this experiment station the Groit gave the largest average yield of seed per plant.

In numerous tests conducted in 1907 and 1908, the Groit has proved to be distinctly superior to the New Era. Mr. J. C. Little, who originally introduced the New Era, considers the Groit fully 25 per cent superior, and at various places in Maryland, Delaware, and Virginia the showing is nearly as great. The Groit has exactly the same habit as the New Era, but is somewhat taller and distinctly more prolific, and at most but a few days later. Upon careful examination, however, it is very easy to distinguish the seed of the Groit from the seed of the New Era. The seeds of the New Era, when viewed under the lens, are seen to have a clay or ocher colored ground color, which may turn to an orange-brown in age, especially if the seeds have become moist. This ground color is thickly strewn with minute specks of a blue-black color. The Groit pea has the same coloration as the Whippoorwill cowpea, with the blue-black specks of the New Era in addition. If the Groit is viewed under the lens one can easily detect the brown splotches of the Whippoorwill, with the fine specks of the New Era apparently superimposed. The seeds of the Groit are usually larger than those of the New Era, and intermediate in form between its two parents. On account of the superiority of this pea, it is important that growers recognize the differences, so that this valuable new variety may receive the attention that it justly deserves.

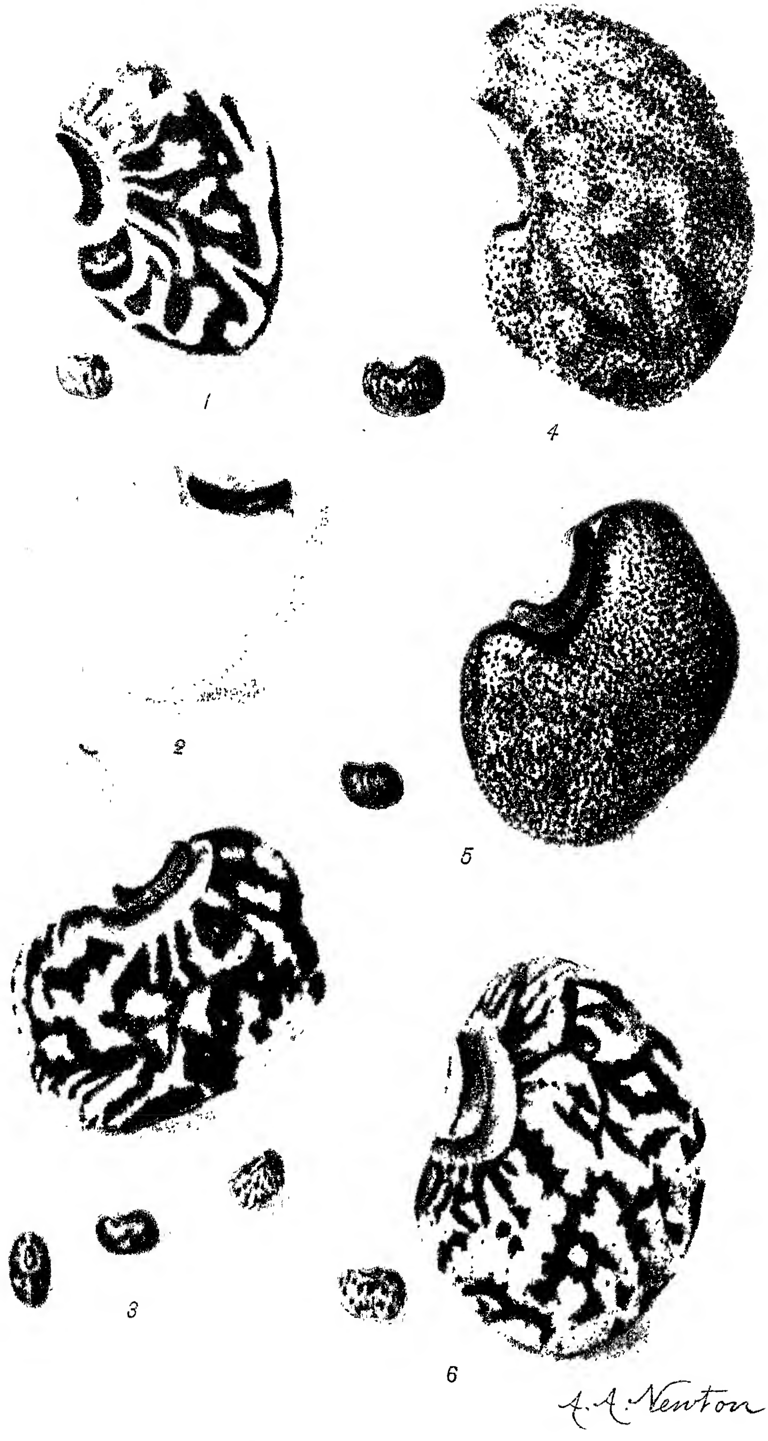


PODS OF TWENTY VARIETIES OF BUR CLOVER NOW BEING TESTED TO DETERMINE THEIR COMPARATIVE AGRICULTURAL VALUE.



FIELD OF HINDU COWPEAS (VIGNA CATJANG) GROWN AT ARLINGTON FARM, VIRGINIA, IN 1908.

[Note the erect or nearly erect pods.]



THE BRABHAM AND GROIT COWPEAS.

[The Brabham cowpea (1) and its parents, Iron (2) and Whippoorwill Half-Crowder (3). The Groit cowpea (4) and its parents, New Era (5) and Whippoorwill (6). Small figures natural size; large figures magnified 5 diameters.]

In regard to the origin of the name Groite, as published by the Missouri experiment station, nothing definite can be learned further than that this name was on the package of seed planted in 1906.

SOY BEANS.

Recent explorations in China and extensive correspondence with missionaries and others have yielded during the past few years a very large number of varieties of soy beans. Fully 200 distinct varieties have now been obtained, showing a diversity of growth and of possible value wholly unsuspected. Previous to these investigations only 5 or 6 varieties were known to American agriculture. The rapidly increasing prominence of the soy bean, especially in the Southern States, makes it important to secure the very best varieties. It is a curious fact that the variety most widely grown in the United States, the Mammoth, which was introduced at least thirty years ago, has never again been obtained. It is equally strange that of the other numerous new varieties obtained, nearly all of them, except certain Japanese varieties, have been secured in only a single locality. The truth is that throughout most of the Chinese Empire every variety is grown locally. Mr. F. N. Meyer, who has traveled widely in China, states that this extreme localization of these varieties is a very striking fact in Chinese agriculture, due, as he thinks, to the fact that for ages every Chinese farmer has grown his own seed, and there has been little or no exchange of seeds from province to province. It would therefore appear likely that numerous other varieties yet remain to be obtained.

Among the new varieties of soy beans are some from far north in Manchuria and Siberia, which mature in seventy to eighty days, and others from southern China that are so late that they scarcely mature in our warmest States. Several of these new varieties in the trials thus far conducted promise to be decidedly superior to the Mammoth variety.

Especially valuable are the Riceland soy beans, grown by the Chinese in rotation with rice. These varieties are very distinct from others and on account of their numerous slender stems, large size, and leafiness make hay of unusually fine quality.

While at the present time soy beans are most important in the Southern and Middle Southern States, they will doubtless in time become of great value in the arid regions on account of their marked drought resistance. Unfortunately, rabbits are extremely fond of soy beans, causing so much destruction that it is practically impossible to grow this crop where these animals abound, as is still the case throughout our semiarid regions.

BONAVIST OR HYACINTH BEAN.

The Bonavist or hyacinth bean (*Dolichos lablab*) is a native of India and contains about twenty distinct varieties. These have been grown more or less in southern Asia for human food, and to a slight extent for that purpose in Europe and this country. They have also been employed quite largely as ornamental climbers. Experiments to determine their possible value as forage have been under way for a number of years. They have been compared especially with cowpeas, both being grown as a field crop for hay and with corn for silage. When grown in fields for hay they have given very promising results in southern Kansas and northern Texas, being at least equal to cowpeas in yield and palatability. Some varieties are heavy seed producers, yielding about as much as cowpeas. The habit of all the varieties is very much more viny than cowpeas, in a general way being intermediate between cowpeas and velvet beans. When grown in Virginia with corn for silage or with sorghum for hay they have outyielded cowpeas, the vines being much more rapid growers. There are two possible objections to them, however. The vines grow very much more rapidly than the cornstalks and tend to bind the rows of corn together, and there is also a much larger mass of herbage covering the ground than in the case of cowpeas, much of which can not be saved in harvesting. (See Pl. XII.)

In Florida and Cuba this bean has also given considerable promise, in Cuba especially being considered superior to the cowpea. Like many other legumes, however, the Bonavist is susceptible both to the root-knot caused by nematodes and to wilt, although it is possible that varieties resistant to these diseases may be found, as has been the case with the cowpea. At the present time, however, the Bonavist offers no particular promise throughout the Cotton Belt except in Texas. In drought resistance it is at least equal to the cowpea and apparently somewhat superior. In all respects it will have to meet the cowpea in competition and it still remains to be determined whether in any part of the country it will be sufficiently superior to the cowpea to warrant farmers generally in growing it. The most hopeful locality for its agricultural utilization at present would seem to be in the semiarid regions, although its possibilities as a silage crop are sufficiently promising to warrant continued investigations. The roots are remarkably well provided with tubercles; indeed, in this respect far surpassing the cowpea.

KULTI.

Kulti (*Dolichos biflorus*) is an annual legume, native of India, where it matures even up to an altitude of 7,000 feet. The plant forms a matted vine which densely covers the ground, and it also read-

ily climbs up other plants, such as corn. It blooms in the latitude of Washington, D. C., but matures very few seeds. It has been tested in many places, but it is only in the semiarid portions of Texas and adjoining States that it seems to possess any marked promise. At Chillicothe, Tex., a late-growing variety produced as much forage as any other annual legume and of an exceptionally fine quality, owing to the slender stems and the persistency with which the leaves are held in curing. The principal objection to it is its viny nature, and yet, as the plant grows under conditions of light rainfall, this is by no means so serious as in humid regions. In India the plant is grown chiefly for its seed, which is eaten by the poorer classes. According to Roxburgh, in dry, light, rich soils it will yield sixtyfold. Other writers state that heavy crops of seed are obtained only where the land is limed heavily, as under other conditions the plant runs to vine. To some extent the Hindus grow it as fodder for cattle, for which purpose it is said to be highly esteemed. It is recognized as an exceedingly good soil improver, increasing the yield of subsequent crops even when the vines are removed for fodder.

From the splendid results that the plants have yielded in Texas the kulti is well worthy of extensive testing in the Southern States.

BUR CLOVERS.

Two species of bur clover have long been grown in the United States. One of these, *Medicago denticulata*, was early introduced into California, where it rapidly spread over the whole State and other Pacific Coast States, behaving much like a native plant. It not only appears spontaneously season after season in orchards and in wheat fields, but forms an important part of the forage on the range lands. So readily does this bur clover, like other species, reseed itself that but little seed is ever gathered, and it can therefore hardly be spoken of as a cultivated plant.

In the Southern States the spotted bur clover (*Medicago arabica*), which was introduced long since, has behaved in very much the same manner. The spotted bur clover in California succeeds nearly as well as its close relative, but is much better adapted to the Southern States, because it will withstand frosts that are destructive to its near relative. About 25 species of bur clover are known to botanists, all annuals. The astonishing variety of pods that the different varieties produce is well shown in Plate XIII. Practically all of these are native to the Mediterranean region of southern Europe, northern Africa, and Asia Minor, and few species grow naturally outside of this area. From an agricultural point of view the species with large smooth pods would on theoretical grounds appear to be the most valuable for forage, as in California especially it is largely the pods that sheep and other animals feed upon. It is

somewhat questionable, however, whether the smooth-podded forms will ever spread over the State in the manner that at least one spiny-podded species has. All of these species have been grown now for three seasons in California, where they all succeed admirably. In cultivation some are distinctly superior to the common California bur clover, but, after all, their value will be determined largely by their ability to spread naturally.

In some varieties the pods are so hard and so spiny that they might become pernicious if introduced. The others are being tested both in California and in the Southern States in the hope that some of them will be found so well adapted to the conditions as to spread naturally. One of these species never before introduced into the United States has long been utilized by the Chinese in their rice fields. It is believed that it will also prove very useful in the same manner on our American rice lands.

VETCHES.

Throughout the Old World there is a very large number of species of vetches belonging to the genus Vicia. Many of these species have been introduced and have been under trial for some years past, especially in the hope of finding some adapted to our semiarid States. The common vetch (*Vicia sativa*) is now extensively grown in the Pacific States and in the Southern States. The hairy vetch is also utilized in these States, and has been found more or less adapted to nearly every State in the Union. Neither of these species, however, is satisfactory in the semiarid States, especially southward. Three of the numerous species that have been tried, however, give much promise of becoming of crop value for these regions, namely, the scarlet vetch (*Vicia fulgens*), a native of North Africa; the black-purple vetch (*Vicia atropurpurea*), a native of Algeria, and the woolly pod vetch (*Vicia dasycarpa*), from the Mediterranean region. Scarlet vetch has given very satisfactory results in Arizona and in southern Texas. It also succeeds admirably in the three Pacific States and in the South. It is much more upright growing and finer stemmed than common vetch or hairy vetch and yields nearly as much per acre. The black-purple vetch has proved far superior to all others in northern Texas; indeed, the results are so promising that there can be little doubt that this vetch is destined to be largely grown in that region. The woolly pod vetch is comparable to the hairy vetch, being quite as hardy and maturing very much earlier in spring. Like the hairy vetch, this has given splendid results in many parts of the country and will be found of high value wherever the hairy vetch is objectionable on account of its lateness.

SUITABLE PAPER FOR PERMANENT RECORDS.

By F. P. Veitch,

Chief, Leather and Paper Laboratory, Bureau of Chemistry.

THE NEED FOR GOOD PAPER.

The greater part of the paper made at the present time is not durable. The causes that contribute to this fact are numerous and not all of them can be controlled. In the first place, the result of the various operations of paper making is a compromise. The operations which make clean, white paper make it weak and subject to slow changes which lead ultimately to its destruction. Those which make a strong paper do not give as clean a sheet and at the same time increase its transparency greatly. The processes which make the paper more opaque make it weaker, and those which give good clear printing or writing qualities hasten its destruction.

Aside from these facts, the materials are often of inferior quality and the operations employed, through haste and a desire to produce large quantities, are so severe that the quality and durability of the resulting paper are greatly reduced.

So universally true is this that several governments have become alarmed for the permanency of their records and have introduced stringent requirements with which record paper must comply. The need in this country for more durable paper is a real one. Important state papers, correspondence, deeds, bonds, certificates, ledgers, court records, and certain printed documents are so valuable that it is absolutely necessary that the paper upon which they are placed should be as nearly indestructible as it can be made. Nor is the quality of the paper the only problem that should give us concern. So rapidly are records of all kinds increasing that their proper storage and safe-keeping is a serious problem. Paper should be not only durable but light and thin, that the burden of its proper handling and storage may be reduced as far as possible.

As a matter of fact, but little attention is given in this country to the quality and durability of paper for any purpose whatsoever. The individual taste of the user or purchaser as to the appearance of the paper plays far too large a part in selection. This is true not only of private purchases but of public purchases as well. Too often

paper is bought without any requirement as to quality, and when it is bought on specifications these are often absolutely inadequate to insure the delivery of paper of the desired or required character.

Government and State officials and agents of publishers and of business firms should give more attention to the purchase of paper used in important records and should buy only on specifications which will insure the delivery of paper suitable for the purpose in view.

There need be no fear that this demand for better paper can not be met. The American paper maker can, and frequently does, produce paper which is beyond criticism, and when the public insists on better paper and will receive no other, it will be produced. The purchaser must fully recognize, however, that, other things being equal, better papers will cost more per pound; that more durable paper may not be so white or uniform in color, nor so free from specks; and that lightness and thinness are secured at the expense of opacity. When the buyer attaches more importance to quality than to appearance, all paper will be better.

HOW GOOD PAPER IS MADE.

The quality of paper is controlled chiefly by the kind of materials used in making it and by the processes by which it is made. The durability of paper is influenced not only by the materials and methods of manufacture employed, but also by the way the paper is used and stored.

MATERIALS.

Paper is made from cotton, linen, and hemp rags and wastes, from chemically prepared woods, from straws, and from wood not chemically prepared. Cotton, linen, and hemp have longer and stronger fibers, which consist of purer forms of cellulose than any of the other materials mentioned. For these reasons paper made from them is not so much affected by either the chemical or mechanical operations of paper making, and does not wear and crack so easily when handled, as paper made from chemically prepared wood or straw or from wood not chemically prepared. In other words, the paper made from the former materials is more durable than that made from the latter.

CHEMICAL PROCESSES.

Just as there are different materials from which widely varying qualities of paper are made, so, too, the chemical and mechanical processes of paper making can be so operated as to yield from a given material papers of widely varying character as to strength, uniformity of texture, flexibility, color, and durability. It often happens, therefore, that a stronger, more durable paper is made from inferior

material than from high-grade material, because in the first instance the processes of making were so operated as to give the best results, while in the second instance these processes, or one of them, was improperly executed. Paper making is yet largely a rule-of-thumb industry and the results of slight variation in procedure are not generally thoroughly appreciated.

The differences in the cooking of the material with chemicals lead to the production of pulp of varying character. If the pulp is not sufficiently cooked, the paper made therefrom will probably be strong when first made, but will not prove durable because of the impurities which were unaffected by cooking and which it still contains. Or, again, this pulp may make a weak and short-lived paper, because in the effort to make from it a well-appearing paper it has been over-bleached, thus causing profound changes in the constitution of the cellulose forming the paper; that is, the severe treatment necessary with the bleaching agent to remove impurities will result in the formation, through the action of the bleaching materials on the fibers, of other compounds not subsequently removed from the paper, the presence of which hastens its decay. When the material is cooked too much the fiber itself is strongly affected thereby and greatly weakened. Furthermore, as impurities have been almost completely removed from the pulp, the bleaching agent next employed is free to exert its full effect on the already weakened fiber. This it does with great rapidity, and the fiber is thereby still further weakened and changed in constitution and rendered more susceptible to other destructive agencies. As a rule, the harmful effects of errors in cooking the pulp are less than those of bleaching because the compounds formed during cooking by the chemicals and impurities of the material are soluble and are removed from the pulp by washing, and because the constitution of the fibers is not as much affected by the chemicals used in cooking as by those used in bleaching. The process of bleaching is chiefly one of oxidation, and the more the fiber of the paper is oxidized the more easily it is changed and destroyed by wear and tear. The action of chemicals on paper is not limited to the time required to make it, but continues, much less actively it is true, as long as the paper lasts. To prevent this, the chemicals used should be thoroughly washed out of the pulp before it is made into paper, as even very small quantities of acids which are added with rosin size, or of bleaching materials, or soluble salts slowly act on paper and gradually make it weak and brittle.

In order that paper may be written or printed on without the ink spreading over the sheet it is necessary to size it. This is done by adding starch, rosin, or glue. These substances do not, as a rule, immediately weaken or injure the paper, but as they are themselves subject to chemical changes or decay in the paper, and as some of

them may add free acids which attack fibers, the durability of the finished product is lessened by the use of sizing materials, and it is therefore necessary that only sufficient quantities to insure well-sized papers should be used.

Paper is usually more or less transparent. This is a particularly objectionable feature in printing papers, and to prevent it other more important qualities are often sacrificed. It is an error to sacrifice strength and durability for the sake of securing a paper which is absolutely opaque. The favorite way of making paper less transparent is to add to the pulp a white mineral, such as china clay, which fills up the pores of the paper and thus makes it more opaque. As this filling material, as it is called, has no fiber, it reduces the strength of the paper and at the same time makes it heavier. For these reasons papers should be so made that they contain as little filling or loading material as will make them sufficiently opaque.

MECHANICAL PROCESSES.

Durability is also influenced by the mechanical operations of beating, forming the pulp into the sheet of paper, and subsequently drying it. It is possible for the paper maker to mash out the fibers, leaving them long with frayed ends, or to cut them into short pieces with blunt ends. He can make harsh, firm fibers or he can make them soft and slimy, and either of these may be long or short. Manifestly, fibers having such widely different physical forms will make paper of different character, strength, and durability, and it is clear that the long, slimy fibers with the frayed ends will interlock more firmly to make a stronger, more durable-to-handling paper than the short, harsh fibers. After the paper is made it must be dried before it is ready for use. It is customary to do this by passing it over steam-heated steel drums. Experience shows that the fewer and hotter the drums—that is, the more rapidly it is dried—the less durable the paper.

HOW THE QUALITY OF PAPER IS KNOWN.

Although the experienced paper maker can make a shrewd guess as to the kind of fiber used simply by the appearance and feel of the finished product and can make a paper closely approximating a sample in appearance from the examination, it is only by means of special tests devised for the purpose that accurate information as to the composition, strength, flexibility, and probable durability can be obtained. Microscopical, chemical, and physical methods are employed in obtaining this information. The kinds of fiber in the paper are learned by examining it under the microscope. In this way not only can the kind of fiber from which the paper was made

be determined, but when several kinds of materials have been used, as is frequently the case, the approximate quantity of each present can be learned. It is, therefore, a simple matter to learn whether a paper has been made of the strongest and most durable materials, such as cotton and linen, of medium-grade materials, like straw and chemically prepared wood, or from nondurable ground wood.

By use of chemical methods the quantity of filler or clay added to the paper is determined. The kind and quantity of sizing material—starch, rosin, glue, or casein—and of acids and salts are also learned through the proper chemical tests.

Experience has demonstrated that materials having long, strong, and flexible fibers make the most durable and strongest paper. Further, the more carefully the materials are carried through the several processes of paper making the stronger the paper is. Strength is therefore generally regarded as a simple and direct means of learning at once not only the general kind of raw materials employed, but also something of the way these materials have been treated in forming them into paper. The strength of paper is, therefore, within limits, an indication of its quality.

In this country the machine most employed for determining strength operates by exerting pressure on the under side of a disk of a known area of the paper. The pressure required to break the paper is registered in pounds on an ordinary pressure gauge. The results obtained are subject to considerable variation and are not as definite as those obtained with testers of a second class, which break a strip of definite length and width, registering the breaking strain directly by means of a movable beam, and with much smaller chances of error. Testers of this type are but little used in this country, but are practically the only kind employed in Europe.

As a strong paper may be very brittle, strength alone is not to be accepted as the final measure of durability in service, but it is necessary to learn as well how flexible the paper is. To supply this information, a machine known as the folder has been devised which closely imitates the folding of paper in documents and books when they are used. In order that these tests may be completed quickly, a strip of the paper of definite width is folded backward and forward upon itself under a constant strain until it breaks. By folding a piece of paper with the fingers one can see how closely this operation imitates the actual folding of documents and the turning of leaves of books. The results thus obtained probably furnish more information as to the quality and durability of paper than any other single test. It not only shows how flexible the fibers of the paper are, but it also shows how firmly they cohere and how well felted together they are. In a general way it indicates at once the character of the raw material and the care with which it has been made

into paper. It is both a test of flexibility and of strength in service. In a way it replaces tests for strength, because papers which fold well are strong papers, though strong papers do not necessarily fold well.

HOW TO PRESERVE PAPER.

It has been stated that the durability of paper is controlled by the materials which it contains, including impurities, and by the way in which these materials are made into paper. The influence of these factors manifests itself in accordance with the conditions of use and storage to which the paper is subjected. Poor quality is soon revealed when the paper is handled, and as even the best paper sooner or later gives way to much handling it is important that valuable documents and publications be handled as little as possible and that the conditions under which they are used be those least injurious.

Documents should have but few folds and books should be so bound that there is no cutting action of the binding on the paper. Valuable paper should be kept in a well-lighted, clean, dry place. It should not be exposed to direct sunlight, however, nor to an atmosphere containing acid fumes, which the atmosphere of rooms lighted by gas frequently contains. Both direct sunlight and acid fumes have an oxidizing action on the paper. Dampness, aside from the direct weakening effect, is particularly favorable to the activity of bacteria and insects, many of which obtain their food from the starch, glue, casein, and sugars which the paper may contain. The injury due to bacteria and insects can be rendered almost negligible by keeping the paper dry and excluding those materials—starch, sugars, glue, and casein—on which the bacteria and insects live. However, as it is not practicable to keep the paper absolutely dry or free from small quantities of the above-mentioned substances, we must compromise in securing the most favorable conditions practicable.

SUMMARY.

Durable paper is only obtained by using the longest, strongest, and most flexible fibers, and by making these into a sheet containing the minimum quantities of other materials, by those methods which cause the least change in the constitution of the fibers themselves; and finally by preserving the paper so made under the most favorable conditions of service and storage. Paper of this character should always be employed in permanent records, which should be so used and stored that they may last indefinitely.

INFORMATION ABOUT SPRAYING FOR ORCHARD INSECTS.

By A. L. Quaintance,

In Charge of Deciduous-Fruit Insect Investigations, Bureau of Entomology.

IMPORTANCE CF INSECT CONTROL.

Insect control in orchards and vineyards is largely effected by spraying, and the needs of the fruit grower in the protection of his crops from the ravages of insects and fungi have been the predominating influences in the development and excellence of present-day spraying apparatus. Nowhere in the world are insecticidal operations more extensively practiced than in the United States. The money which is spent in this country each year for labor, apparatus, chemicals, etc., in insect warfare is a very large sum, amounting in the case of the codling moth to not less than $5,000,000 and an equally large sum is spent in treatments against the San Jose scale. Although spraying is without doubt the most expensive of the several orchard operations, the value of the crop is so greatly enhanced thereby that it is a comparatively small investment, the expense amounting to but a fraction of the returns directly due to the practice. Orchard spraying is, in fact, an exceedingly cheap form of insurance.

It must not be inferred, however, that spraying operations are uniformly successful; in fact, this is far from being the case. Of all orchard work, spraying is most likely to be slighted or even neglected. Numerous fruit growers have not even adopted the practice, and others are not sufficiently familiar with the details of the work to secure reasonably satisfactory results. Inadequate knowledge of the essential features of spraying has been a serious drawback to the extension of its use. Many orchardists have no standard or conception of what constitutes thorough work and are practically without knowledge of their insect foes. Under such conditions results in most cases are unsatisfactory, and in the estimation of some this has given rise to the opinion that spraying is without merit.

The term "spraying," unfortunately, has come to have a rather general meaning, and it is apparent that many fruit growers and others do not understand that the kind of spray and the manner of application depend upon the character of the insects to be controlled.

While it is entirely practicable, as will be later shown, to indicate a system of orchard spraying to control the important insects and fungous diseases, such a system must take account of the peculiarities of the troubles in question. A better understanding by orchardists of the whys and wherefores of spraying would result in a marked improvement in the vigor of orchards and the quality of the fruit, and an important saving in expense for labor and materials.

HOW INSECTS FEED.

A knowledge of the character of the mouth parts of insects is of importance to the fruit grower as determining the general character of sprays to be used. Broadly speaking, all insects secure their food in one of two ways—(1) by actually biting out and swallowing portions of the food material, or (2) by sucking out the juices from the interior portions of the host. While there are exceptions to this general statement, these are unimportant in the present connection.

The biting and the sucking types of mouth parts are on two quite distinct plans. In the former there are two horny, opposable jaws, working sideways, and certain accessory appendages, with which particles of the leaf, bud, fruit, or other food substances are cut out and passed on as more or less solid particles to the food canal for digestion.

This type is found in several orders of insects, as in caterpillars, or the larvæ of moths and butterflies; the grubs and adults of Coleoptera, or beetles; grasshoppers, crickets, and other Orthoptera; and sawflies, bees, etc., of the order Hymenoptera. All biting insects are subject to destruction with stomach poisons, as arsenicals. Some insects do not feed in situations where poisons may be applied, those, for instance, which feed on the interior portions of plants (apple-tree borers, the peach borer, etc.), and on the roots.

In insects having sucking mouth parts the mandibles and maxillæ are drawn out into long setæ, or bristles, which are inclosed in the greatly modified tubelike lower lip, or beak, the four setæ and beak constituting a sucking apparatus with which juices may be drawn up from plants. In feeding, the beak is placed upon the plant surface or slightly inserted. The threadlike bristles are pushed down into the plant, and by a pumping action of the fore part of the food canal the sap is readily extracted. Plant-lice, scale-insects, leaf-hoppers, the pear psylla, and the true bugs, very important enemies of the horticulturist, are sucking insects, and for their control contact sprays are used, such as corrode the body or penetrate the breathing pores (lime-sulphur wash, whale-oil and other soaps, kerosene emulsion, etc.).

Biting and sucking insects often occur in a way to permit of their practical destruction by poisoning the air which they breathe, as with hydrocyanic-acid gas or carbon bisulphid. The fumigation of trees with hydrocyanic-acid gas, or "gassing," is extensively practiced in California in the destruction of scale insects infesting citrus trees, and also in Florida against the white fly. Its value for similar purposes against certain deciduous-fruit insects, especially the San Jose scale, was fully tested under eastern conditions, and while practicable for smaller trees it has never been adopted to any extent for the reason that the expense of the operation in proportion to the value of the crop produced is relatively high. Deciduous and other nursery stock, however, is now regularly fumigated by most nurserymen to guard against the possible dissemination of injurious insects. Carbon bisulphid is useful against underground species, as the woolly apple aphis, grape phylloxera, etc.

SPRAYING DORMANT TREES.

The spraying of trees during winter and spring, or when they are in a dormant condition, is directed largely against scale insects, especially the San Jose or Chinese scale. There are two principal advantages in spraying at this time: (1) the absence of foliage permits of more thorough applications, and (2) the sprays may be used much stronger than during the growing season. Contact sprays are employed, as whale-oil and other soaps, kerosene and crude petroleum emulsions, miscible oils, lime-sulphur wash, etc. The prime essential is thoroughness in making applications, covering every part of the tree from top to bottom, as in general only those insects coming into actual contact with the spray are killed.

Applications may be made in late fall, as soon as most of the leaves have fallen, at favorable times during the winter when the temperature is above the freezing point, or, preferably, in the spring shortly before the buds are due to swell. Spraying in late fall and early winter is thought by some to be more effective than later, on the supposition that the scale insects are not yet entirely dormant; and the prevailing fair weather at this season and the usual slackness of work are additional reasons for fall spraying. However, the danger of injury to fruit buds and twigs, especially from the use of mineral oils and whale-oil soap, is unquestionably greater. On the whole, fall spraying has not yet come into extensive practice; although often attended with unfavorable weather conditions, the work is mostly done in the spring. In the case of lime-sulphur wash, notably better results follow spraying late in spring, to insure as large an amount of spray on the trees as possible during early summer, and thus destroy any young scales from adults which may have escaped destruction.

In fact this continued action of the wash is perhaps quite as important as its first effect.

Spraying dormant trees for the San Jose and other scales and for other insect pests has come to be a very important part of orchard work, especially in the East and also on the Pacific slope, and in general it is possible so to time this work that a single application will reach most of the troubles. Other things being equal, the insecticide having the greatest range of usefulness should be employed. Of the several dormant-tree sprays, the standard lime-sulphur wash is the one most generally used and is equally effective against many other insects which may coexist on the trees. It is an excellent fungicide, and, aside from the inconvenience experienced in its preparation and its disagreeable character, it furnishes an ideal dormant-tree spray. Abundant experience has shown it to be an effective remedy in the control of the San Jose scale under all conditions, and also for most other diaspine scales, as the cherry scale (*Aspidiotus forbesi*), the walnut scale (*Aspidiotus juglans-regiæ*), the West Indian peach scale (*Diaspis pentagona*), the European fruit scale (*Diaspis ostreæformis*), and reasonably so against the oyster-shell scale (*Lepidosaphes ulmi*), and the scurfy scale (*Chionaspis furfurus*). Lecanium scales, such as the terrapin scale (*Eulecanium nigrofasciatum*) and the brown apricot scale (*Eulecanium armeniacum*), are more effectively controlled by mineral-oil sprays, though in orchards regularly treated with lime-sulphur wash these will be kept in check. One thorough treatment each year, therefore, with lime-sulphur wash will keep well under control practically all scale-insect pests of the orchard.

Prof. J. M. Aldrich has shown that the lime-sulphur wash is effective in destroying on twigs and branches the winter eggs of the aphides affecting the foliage of the apple. It has been found effective in destroying the eggs of the pear-tree psylla (*Psylla pyri*), which are deposited on the trees very early in the season by the over-wintering adults. It has long been known to be effective in destroying the pear-leaf blister-mite (*Eriophyes pyri*), which passes the winter under bud scales of pear and apple and attacks the expanding foliage in the spring. Eggs of the red spider and of clover and other mites are probably also destroyed, as well as those of various insects. In California, if applied in late spring, it has been found effective in destroying the peach twig-borer (*Anarsia lineatella*). The wash is also a valuable fungicide; if applied before the buds open, as for the San Jose scale, it effectively controls the leaf curl of the peach. Used at this time on apple it replaces the dormant treatment for apple scab, and its usefulness in the same way for pear scab is very probable.

Against some of these troubles it must be used in spring shortly before the buds open, and is about as effective against all when used at this time. In practice, therefore, the plan should be to make one thorough application of lime-sulphur wash to orchards each spring as a general treatment for the control not only of the San Jose but of many other scale insects and other pests.

SUMMER SPRAYING.

By summer spraying is meant applications during the period of foliage. The work is directed principally against bud, leaf, and fruit eating insects, and an arsenical is chiefly used. Contact insecticides, exclusively used in dormant-tree spraying, are also employed in a dilute condition in the control of certain insects, as aphides, the pear psylla, leaf-hoppers, etc., but by far the largest part of summer spraying consists in the application of arsenicals, either in water or more generally in Bordeaux mixture,[a] effecting in the latter case combination treatments for fungous and insect troubles.

Two arsenicals are chiefly used, namely, Paris green and arsenate of lead, though numerous others are available, as arsenite of lime, Scheele's green, etc. The aim is to use these about as strong as the foliage will stand without injury, though well-made arsenate of lead, a comparatively recent addition to arsenical insecticides, may be used in unnecessarily large quantities without injury to most plants. The foliage of some fruits, as apple, pear, quince, and grape, is but rarely injured by effective strengths of Paris green, and perhaps never by well-made arsenate of lead. But the foliage of stone fruits, as cherry, plum, and peach, is on the whole quite tender, and arsenicals must be employed with caution. Arsenate of lead is least likely to do harm, though repeated applications of this poison, especially to peach, may cause shot-holing and dropping of leaves and burning of the fruit.

Summer spraying is perhaps more practiced in the case of the apple than in that of any other fruit, and because of the importance of the apple its treatment deserves detailed consideration.

The principal pests to be controlled are the codling moth, the plum and apple curculios, and the lesser apple worm, which affect the fruit; and the bud moth, canker-worms, and tent caterpillars, which eat the foliage. While these several pests exhibit individual peculiarities in feeding, a system of spraying which will be effective in controlling or greatly reducing them is about as given on the page following.

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[a] For information as to the preparation and use of Bordeaux mixture and other fungicides see Farmers' Bulletin 243, U. S. Dept. Agr., by M. B. Waite.

SCHEME FOR SPRAYING APPLE ORCHARDS.

FIRST TREATMENT.—In orchards infested with the bud moth (*Tmetocera ocellana*), spray with arsenate of lead or Paris green just as buds are swelling.

SECOND TREATMENT.—Spray with arsenate of lead or Paris green in Bordeaux mixture when cluster buds are out, but before the blossoms open. This treatment is valuable against the bud moth, canker-worms, plum and apple curculios, tent caterpillar, etc.

THIRD TREATMENT.—As soon as the petals have fallen, spray very thoroughly with arsenate of lead or Paris green in Bordeaux mixture so as to place a dose of poison in the calyx cup of each young apple. Larvæ of the codling moth, the principal cause of wormy apples, hatching some three or four weeks later, mostly enter the fruit at the blossom end, and are thus killed. This is the most important of all treatments for the codling moth and is valuable in destroying the lesser apple worm (*Enarmonia prunivora*), plum and apple curculios, canker-worms, tent caterpillars, etc.

FOURTH TREATMENT.—Three or four weeks after blossoms have fallen, use an arsenical in Bordeaux mixture, thoroughly coating the foliage and young fruit. This is valuable against the codling moth, and affords further protection against the insects above mentioned.

FIFTH TREATMENT.—An additional application of an arsenical in Bordeaux mixture is necessary, nine or ten weeks after the blossoms fall, for the second brood of the codling moth, and, in the Middle and Southern States especially, a sixth treatment is advisable two or three weeks later. In orchards not infested with the bud moth and canker-worms the first and second treatments may be omitted. The third, fourth, and fifth applications will suffice to give protection from most insect pests of the fruit and foliage, supplemented by the sixth for the territory indicated.

Stone fruits, as compared with apple, pear, grape, etc., are but little sprayed with arsenicals, mostly on account of their greater susceptibility to injury. In some of the northern States, as Pennsylvania, New York, and Michigan, and also in Canada, arsenicals are used more than in the Middle and Southern States, where the injury is more pronounced. *Domestica* or European varieties of plums, including prunes, are less injured, and there seems to be but little if any injury to these from moderate use of arsenate of lead. The peach is more sensitive; three or four applications of an arsenate of lead spray may cause much of the foliage to fall and result in the scalding and dropping of the fruit. Cherries and Japanese plums also are tender, and arsenicals must be used on these with caution.

In the case of stone fruits the principal pest to be controlled with arsenicals is the plum curculio, and the first application should be made just before the buds open. Many of the beetles are out feeding at this time and will be destroyed. A second treatment is made within a few days after the blossoms fall, and a third about ten days later. The latter treatment on peach and Japan plum, in the Middle and Southern States. is attended with increased risk. Lime should

always be used with arsenicals on stone fruits. These treatments are very effective against the curculio and result in a notable increase of first-class fruit. As this insect makes conditions very favorable for infection from brown rot, its control greatly reduces the latter. In general, only well-made arsenate of lead should be used on stone fruits, and in the case of peach only two applications should be given. The injury which results depends considerably on the character of the weather.

In the case of the grape, as in that of the apple, it is practicable to indicate a scheme of spraying which will be effective against the principal insect pests, and, if the arsenical be used in Bordeaux mixture, against important diseases as well.

GENERAL CLASSIFICATION OF INSECTICIDES.

As already indicated, the important insecticides may be grouped principally into three series, as follows:

Insecticides for biting insects (stomach poisons).—Paris green, arsenate of lead, arsenite of lead, arsenite of lime, arsenite of soda, Scheele's green, London purple, white arsenic, hellebore, dust spray.

Insecticides for sucking insects (contact sprays).—Lime-sulphur wash, caustic-soda-lime-sulphur wash, self-boiled lime-sulphur wash, whale-oil soap, kerosene emulsion, crude petroleum emulsion, "distillate" emulsion, tobacco decoction, pyrethrum, caustic soda, caustic potash, lime dust, carbolic-acid emulsion, sulphur spray, resin wash, etc.

Fumigants.—Hydrocyanic-acid gas, carbon bisulphid, sulphur dioxid, effective against all classes of insects.

Stomach Poisons.

Paris green.—Paris green is the best known and most generally used of all arsenicals in orchard spraying, though arsenate of lead is rapidly growing in favor. Paris green is a definite chemical compound—the aceto-arsenite of copper—and when pure contains 58.65 per cent of arsenious acid, 31.29 per cent of copper oxid, and 10.06 per cent of acetic acid. The commercial article, as used in spraying, should contain 56 per cent arsenious oxid and not to exceed 4 per cent, preferably 3 per cent, soluble arsenic. If there be appreciably more than this, danger of burning foliage is greatly increased. Well-made Paris green should be of a beautiful green color, very fine and dry, free from grit, and perfectly smooth when rubbed between the fingers. This poison is sometimes adulterated, though the Paris greens on the market in this country, on the whole, average exceedingly well. Common adulterants are finely ground sand and gypsum and also common white arsenic. Pure Paris green will entirely dissolve in strong ammonia, and any sediment left over is an adulterant. Ammonia also dissolves white arsenic crystals, and where adulteration with arsenic is suspected it is best to submit samples to proper

authorities for analysis. Paris green is used on pome fruits and grapes at the rate of 1 pound to 100 or 150 gallons of Bordeaux mixture or water. When used in the latter, there should always be added the milk of lime from slaking 2 or 3 pounds of good stone lime for each 50 gallons of spray. Used in Bordeaux mixture the lime is unnecessary. Used at the rate of 1 pound to 100 gallons, there is sometimes burning of the foliage, and the weaker strengths are thus safer but less effective. Paris green should not be used on peach, cherries, or Japan plums, and only with extreme caution on other stone fruits. As this poison is heavy and rapidly sinks, adequate provision for agitation of the liquid in the spray tank should be made.

Arsenate of lead.—Arsenate of lead is coming into quite general use in orchard spraying, replacing Paris green, over which it has some advantages, although it is more expensive. The well-made product contains no free arsenic and is practically insoluble in water, and hence may be used at almost excessive strengths without injury to most foliage. It is quite adhesive and is not washed readily from the trees by rain, and on account of its finely divided condition remains in suspension much better than Paris green. It is, however, weaker than this latter, and to obtain the same arsenical equivalent three or four times more arsenate of lead must be used. This poison has been on the market for several years, and recently the number of manufacturers has considerably increased. The commercial brands are on the whole quite satisfactory, and are mostly used in preference to its home preparation. The commercial product should contain not less than 50 per cent actual arsenate of lead, and is used at the rate of 2, 3, or 4 pounds per 50 gallons of water or Bordeaux mixture. On stone fruits the lesser strength is preferable, applied in water, with the milk of lime from slaking 2 or 3 pounds of good stone lime.

Arsenate of lead may be made at home from the ingredients used in its commercial manufacture. The quantities for 50 gallons of spray, on the basis of 2 pounds of the commercial product for each 50 gallons of liquid, are: Arsenate of soda, 10 ounces; acetate of lead, 25 ounces. The two ingredients are dissolved separately in wooden or stone vessels, using about a gallon of water, preferably hot. When dissolved these are poured simultaneously into the spray tank or other vessel containing the required amount of water. The milky white precipitate which forms is the arsenate of lead, and from its fineness remains in suspension better than any other arsenical. Also, the ingredients may be dissolved and kept separately, as stock solutions, to be brought together as needed. Thus, dissolve 31 pounds 4 ounces of arsenate of soda in 50 gallons of water by suspending it in a gunny sack from near the top of the barrel; similarly treat 78 pounds 2 ounces of acetate of lead. After thorough stirring, 1 gallon of each is used for each 50 gallons of spray, thus giving the amount of poison indicated in the above formula.

The homemade arsenate of lead is somewhat cheaper than the commercial product; its preparation, however, is complicated from the fact that it is difficult to get chemicals of a known strength. The arsenate of soda especially is likely to vary in its composition, and may be adulterated with common salt. The orchardist should, therefore, obtain from the dealer a guaranty of purity of the respective ingredients and should also secure a statement showing the exact quantities of each which should be used to produce complete combination.

Arsenite of lime.—Arsenite of lime is made by combining lime and white arsenic, and the product is insoluble tricalcic arsenite. This is the cheapest of all of the arsenical insecticides, and while it has never been extensively employed there is abundant evidence that it is effective, and when properly made

it is quite safe for use on the hardier foliage, as of apples, pears, and grapes. Two methods of preparation have been recommended, as follows:

According to the Kedzie formula, boil together for fifteen to twenty minutes, or until dissolved, 1 pound white arsenic and 4 pounds sal-soda crystals (or 2 pounds of the anhydrous form) in 1 gallon of water, finally replacing any water lost by evaporation. This is the stock solution, and should be placed in a jug and properly labeled. One pint is used with each 40 or 50 gallons of Bordeaux mixture or water. When used in water there must always be added the milk of lime made from slaking 2 or 3 pounds of good stone lime, which is necessary to produce the arsenite of lime. When used in Bordeaux mixture, no additional lime is necessary in this or the following formula.

By the Taft formula, 1 pound white arsenic and 2 pounds of freshly slaked lime are boiled together for forty minutes or more in 2 gallons of water, and this furnishes sufficient poison for from 300 to 400 gallons of spray. This is not as reliable as the former, since it is difficult to tell if all the arsenic has combined with the lime. When used simply in water, milk of lime is added as in the preceding formula. It is better to make this poison up only as needed, as the arsenite of lime on standing settles into a compact mass difficult of working free in water.

Scheele's green (green arsenoid).—This is the simple arsenite of copper, containing no acetic acid; it also differs from Paris green in being more finely divided, and is of a dull whitish-green color. Lacking the acetic acid, it is cheaper than Paris green. It is used as is Paris green, in Bordeaux mixture or water, and at the same strength.

White arsenic.—With unimportant exceptions, all insect food-poisons at present used have arsenic as the active killing agent. The arsenic may be variously combined, as with copper and acetic acid in Paris green, with copper simply in Scheele's green, or with lead in arsenate of lead. White arsenic is the cheapest form of the poison, but is little used in orchard work on account of its caustic effect on foliage. A considerable proportion of white arsenic dissolves in water, penetrating and killing the plant tissues. White arsenic is sometimes used as an adulterant of Paris green and other arsenical insecticides and while raising the percentage of arsenic does so at the risk of injury to the foliage.

Arsenite of lead.—Arsenite of lead, on account of its causticity, is but little used in orchard work. Serious injury to plants has resulted from its mistaken employment as the arsenate of lead. It is made in the same manner as the latter, using 4 pounds acetate of lead and 12 ounces arsenite of soda, which furnishes sufficient poison for 150 gallons of spray.

London purple.—London purple is a by-product in aniline dye manufacture, the poison being in the form of arsenite of lime. The composition of London purple is quite variable, greatly interfering with its usefulness. It is a finer powder than Paris green and is used in a similar way. It is at present but little employed in orchard work.

Hellebore.—The powdered roots of white hellebore are at times recommended as a substitute for the arsenicals, especially upon fruit which is ripe or nearly so. It is applied dry, diluted with from 5 to 10 parts of flour, or in water at the rate of 1 ounce to the gallon. It acts as an internal poison to insects, but is harmless to man in the quantities recommended. Its expense prohibits its use, except on a small scale.

Dust sprays.—These, while of variable composition, usually consist of lime dust, Paris green or other arsenical, and dry Bordeaux mixture or powdered

bluestone for fungous diseases. A formula by W. M. Scott[a] for dry Bordeaux and lime is as follows:

"Four pounds of copper sulphate in 4 gallons of water; 4 pounds of lime in 4 gallons of water; 60 pounds of slaked lime dust. Dissolve the 4 pounds of copper sulphate in 4 gallons of water and slake 4 pounds of lime in 4 gallons of water. When cool pour the two solutions together simultaneously into a tub. Allow the resulting precipitate to settle, decant the liquid, pour the wet mass of material into a double flour bag, and squeeze out as much water as possible. Then spread out the doughlike mass in the sun to dry. After a day's drying it can easily be crumbled into an impalpable powder by crushing with a block of wood or even with the hand. This powder should be screened through a sieve of brass wire having at least 80 meshes to the inch and should then be thoroughly mixed with 60 pounds of slaked lime dust."

To this should be added about two pounds of Paris green, and very thoroughly mixed with it, making a combination fungicide and insecticide for biting insects. Dust sprays are applied to trees by air-blast machines, and owing to the rapidity with which the work may be done they effect a considerable saving in time and labor. Their use against the codling moth and other biting insects has been shown to be less effective than liquid poisons, and dry Bordeaux is notably less effective in the control of diseases than the freshly made liquid Bordeaux mixture.

Contact Sprays.

Contact sprays are used against sucking insects and kill by corroding the body or by stopping the breathing pores.

Soap washes.—Ordinary soft soap and laundry soaps have long been employed against soft-bodied insects, as aphides, scale insects, etc., and certain soaps are now manufactured especially for insect work.

Whale-oil soap.—Whale-oil-soap wash when used on trees in foliage, as against aphides, the pear psylla, etc., is made by dissolving 1 pound of soap in 3 or 4 gallons of water, or even more dilute solutions may be effective. As a dormant-tree treatment for scale insects a strength of 2 pounds of soap to each gallon of water is necessary, and the wash should be applied hot, as at this strength it becomes difficult to spray upon cooling. Applications of soap washes are best made in spring, shortly before the buds swell, as fall and early winter treatments appear more likely to injure the fruit buds. These soaps are variable in composition and care should be exercised in their purchase. A potash fish-oil soap is preferable to one made with soda, and should contain not over 30 per cent of water. The cost of the soap wash for large-scale dormant-tree spraying is prohibitive; it is useful, however, where but a few trees are to be treated.

Lime-sulphur wash.—This has become the main reliance in spraying scale-infested orchards, and, as elsewhere pointed out, is effective in controlling numerous other insects and is valuable for certain fungous troubles. The following formula is used only on dormant trees, as it is quite too strong for foliage:

Stone lime	pounds	20
Sulphur (flour or flowers)	do	15
Water to make	gallons	50

[a] Farmers' Bulletin 243, p. 11.

Preparation.[a]—Heat in a cooking barrel or vessel about one-third of the total quantity of water required. When the water is hot add all the lime, and at once add all the sulphur, which previously should have been made into a thick paste with water. After the lime has slaked, about another third of the water should be added, preferably hot, and the cooking should be continued for an hour, when the final dilution may be made, using either hot or cold water, as is most convenient. The boiling due to the slaking of the lime thoroughly mixes the ingredients at the start, but subsequent stirring is necessary if the wash is cooked by direct heat in kettles. If cooked by steam, no stirring will be necessary. After the wash has been prepared it must be well strained as it is being run into the spray pump, or tank. The wash may be cooked in large kettles or preferably by steam in barrels or tanks.

SELF-BOILED LIME-SULPHUR WASH.—A wash made by the heat generated from the slaking of lime has been more or less used as a dormant-tree spray for the San Jose scale, and while a diversity of opinion prevails as to its efficiency, results on the whole have not been very satisfactory, and practically it has fallen into disuse as a winter treatment.

The recent discovery by Prof. W. M. Scott, of the Bureau of Plant Industry, of the usefulness of the self-boiled wash as a fungicide for trees in foliage, more especially the peach, has suggested, as was pointed out by him, its probable usefulness as a summer treatment for the San Jose and other scales. Thus far there has been no very satisfactory summer spray for this insect. During the summer of 1908 experiments were made by the Bureau of Entomology on scale-infested peach and apple trees, which showed that this wash, thoroughly applied, will largely free the trees from scale by preventing the settling of the newly developed "lice" and with no injury to the foliage. From two to three applications should be made, the first as the young "lice" begin to crawl in late spring and the subsequent applications at intervals of three or four weeks. The summer treatments can not be made with desired thoroughness on account of the presence of leaves, and should not be expected to replace the dormant spraying with the stronger boiled wash. But in case winter spraying was neglected or not satisfactorily accomplished, summer treatments are desirable to protect trees from injury during the growing period. These treatments, furthermore, as shown by Mr. Scott, are quite effective in preventing various fungous diseases.

The mixture that gave the most promising results was composed of 10 pounds of sulphur (flowers or flour) and 15 pounds of fresh stone lime to 50 gallons of water. This mixture may be prepared as follows:

Place the lime in a 50-gallon barrel and pour 2 or 3 gallons of cold water over it. Immediately add the sulphur and 2 or 3 gallons more of cold water. The heat from the slaking lime will boil the mixture violently for several minutes. Some stirring is necessary to prevent burning, and more water should be added if the mass gets too thick to stir; but the cooking is more effectual when the minimum quantity of water is used, usually from 6 to 8 gallons being required. When the boiling ceases dilute with cold water to make 50 gallons, stir thoroughly, and strain through a sieve of about 20 meshes to the inch in order to take out coarse particles of lime, but all the sulphur should be carefully worked through.

[a] For a detailed account of the lime-sulphur wash, see Yearbook, U. S. Dept. Agr., for 1906.

PETROLEUM OILS.

The mineral or petroleum oils in one form or another comprise some of the most important insecticidal agents against sucking insects, as aphides and scale insects. They are best used in emulsions, for as a rule the use of undiluted oils is attended with grave danger to plants.

KEROSENE EMULSION.—Kerosene may be emulsified with milk or soap, the latter being now more generally used. The soap emulsion is made as follows: Kerosene, 2 gallons; whale-oil or other soap, ½ pound; water, 1 gallon. The soap is finely divided and dissolved in boiling water, and after removal of vessel from fire the oil is immediately added. The whole is violently agitated while hot by thorough stirring, or preferably it should be pumped back upon itself through a force pump for from three to five minutes. After sufficient pumping the mixture will have increased considerably in bulk and assumed the color and consistency of cream. Well-made emulsions should keep indefinitely, and may thus be kept in stock to be used as needed. The spray should contain from 20 to 25 per cent of kerosene for use on dormant trees and from 6 to 12 per cent of kerosene for summer spraying.

CRUDE PETROLEUM EMULSION.—This is made as described for kerosene emulsion. The grade of oil used is known as "insecticide" oil, and should show a clear, amber color with a specific gravity of from 43 to 45° Baumé. On dormant trees this emulsion should contain from 20 to 25 per cent of crude petroleum. As a summer spray the kerosene emulsion is preferable, as there is a residuum in the petroleum emulsion which upon drying may result in injury to foliage.

PURE KEROSENE TREATMENT.—Pure kerosene is used in a very limited way, more particularly in aggravated cases of San Jose scale infestation, and must be employed with caution to avoid injuring the trees. Applications should be made on bright, sunshiny days, using merely enough oil to wet the plant, ceasing to spray before the oil commences to drip to any extent. On a moist, cloudy day evaporation of the oil on the trees is slow, and the fruit buds or even the twigs and limbs may be killed.

PURE CRUDE PETROLEUM TREATMENT.—This is used in the same way as the kerosene, and the same grade of oil is used as in the crude petroleum emulsion.

OIL IN MECHANICAL EMULSION WITH WATER.—The trouble of making emulsions has led to the development by manufacturers of spray pumps designed to automatically mix in the operation of spraying, in any desired percentage, the oil and water. On the whole, pumps of this class have been found unreliable, as not discharging the percentage of oil indicated, resulting in injury to trees or ineffective results, and are now but little employed.

MISCIBLE OILS.—Under this head are to be included certain proprietary preparations, developed especially as a treatment for the San Jose scale. These consist largely of a mineral oil, rendered soluble by a small percentage of a vegetable oil, as resin oil, and an alkali. They mix readily with water and are useful where it is desired to obviate the trouble of preparing a wash, especially for the treatment of small orchards.

Miscible oils have recently been investigated by Prof. C. L. Penny [a] and he has indicated formulas for their home preparation. There are two distinct stages in the making of a miscible oil: (1) The preparation of the emulsifier, or soap solution; (2) the mixing of the emulsifier with the petroleum oil and

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[a] Bul. 75, Del. College Agr. Exp. Sta.; Bul. 85, Pa. State College, Agric. Exp. Station.

resin oil, thus producing the miscible oil. The spray proper results from a third process—diluting the miscible oil with necessary water.

Preparation of emulsifier.—In the preparation of the emulsifier an iron kettle is necessary, ranging in size from 30 to 80 gallons, or more, depending upon the scope of work to be done. A board cover should be provided and a thermometer with scale inclosed in glass and reading to 400° F. The formula for the "emulsifier" or soap solution is as follows:

Menhaden oil	gallons	10
Carbolic acid	do	8
Caustic potash	pounds	15

This is heated to 290° or 300° F. and then the following are added:

	Gallons.
Kerosene	2
Water	2

The kerosene is added at once after the above temperature has been reached, but the water must not be added until the mixture has cooled to at least 212° F., or below the boiling point. Otherwise, a slight explosion of steam may result. This mixture is inflammable when hot and proper precautions are necessary to prevent its igniting.

Mixing emulsifier and oils.—In the mixing of the above-described emulsifier with petroleum and other oils, no heat is required. The emulsifier may be used with kerosene or with crude petroleum with or without the addition of resin or other oils. Numerous formulas for miscible oils are given, of which the following is said to be the easiest made and most efficient as a dormant-tree spray:

	Gallons.
Soap solution (emulsifier)	$3\frac{3}{8}$
Paraffin oil	40
Rosin oil	6
Water as required by test.	

These several compounds are brought together in an open barrel or tank and all are mixed by thorough stirring, sufficient water being added to give a ready emulsion. Although heat is not needed, extreme cold, as when the temperature is around the freezing point, will prevent perfect mixing. Preferably the materials should be kept in a moderately warm room some hours before mixing.

Dilution for spraying.—For use the miscible oil is diluted with the desired amount of water by thorough stirring. From $3\frac{1}{2}$ to $4\frac{1}{2}$ gallons of the miscible oil are used to make 50 gallons of spray.

OTHER PREPARATIONS.

Soluble sulphur solution.—The trouble incident to the preparation of the cooked lime-sulphur wash has also led to the introduction by manufacturers of several so-called soluble sulphur solutions, represented to contain the essentials of the boiled lime-sulphur wash, and these are coming into use as a substitute for the cooked wash. They possess distinct merit and if used of sufficient strength are reasonably satisfactory, and have a field of usefulness for the small home orchard and elsewhere.

Tobacco solutions.—Strong tobacco extracts or decoctions are valuable sprays against aphides, thrips, etc., and are coming into an increased use, especially against the aphides occurring on the foliage of the apple and other

plants. A proprietary tobacco extract on the market has given good results. Tobacco decoctions must be made quite strong to give an effective spray, as in the proportion of 1 pound of stems or leaves to each gallon of water.

CAUSTIC LYE AND SODA WASHES.—Washes made by dissolving lye or soda in water are at times employed on dormant trees against scale insects, but are less effective than the soap, oil, or lime-sulphur sprays. The caustic should be used at the rate of 1 pound to 3 or 4 gallons of water, and at this strength is very disagreeable to handle. The effect on the trees, however, is to brighten them up, and the orchardist is often misled, on this account, as to their real value in killing insects which may be present.

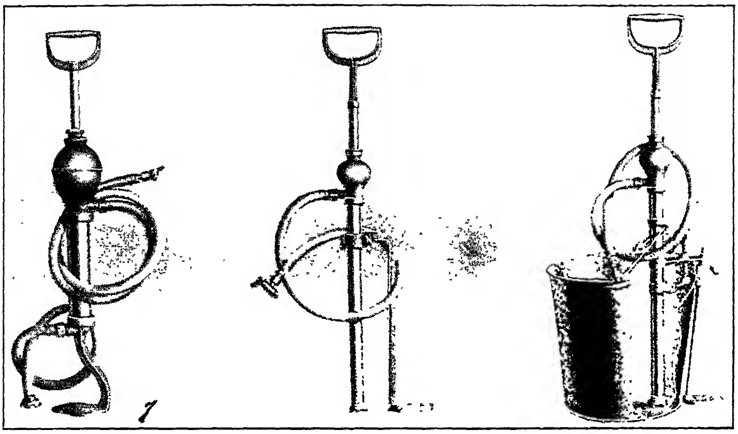
SULPHUR SPRAY.—Flowers or flour of sulphur is useful against plant mites such as the red spider, etc., and may be dusted over the trees, while wet with dew or after a shower, by means of a dusting machine. A more satisfactory means, however, is to render the sulphur soluble with caustic potash or soda. There are several formulas for the preparation of sulphur spray, the one recommended by this Bureau being as follows:

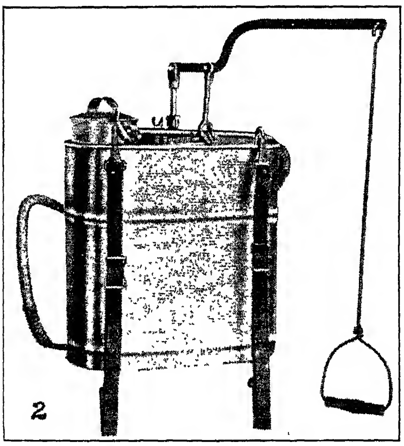
Mix 20 pounds flowers of sulphur into a thick paste with cold water and add 10 pounds pulverized 98 per cent caustic soda, by which the sulphur will be liquefied with much heat. Stir and add water to prevent burning, finally diluting with water to make 20 gallons. This is a stock solution, 2 gallons being used for each 50 gallons of spray, or even stronger without injury to the foliage.

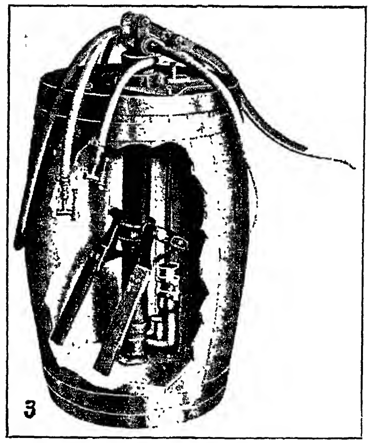
SPRAYING APPARATUS AND ACCESSORIES.

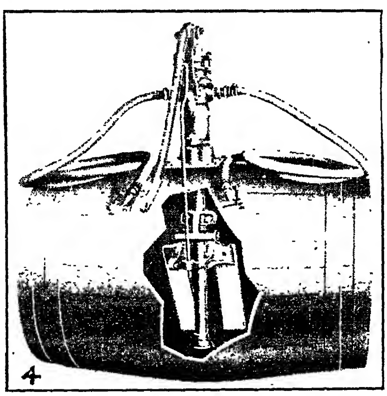
The rise of spraying apparatus in the United States for orchard use dates from about 1880, but it was not until some years later that the question of its manufacture was seriously taken up. Barrel pumps were first used and they sufficed to show the possibilities of protecting crops by spraying with proper apparatus, and the demand for machinery for applying liquids to trees increased rapidly. Steam-power sprayers were apparently first used in 1894, and a gasoline outfit was used a year later. During the years of evolution of spraying machinery great improvements have been made, and many of our present-day outfits possess a high degree of efficiency. These range from small hand outfits to power apparatus, representing several different principles, and the prospective purchaser is often at a loss to know which is best to procure. The answer to the question often asked, as to which is the best spray pump, depends upon the conditions under which the machine is to be used, as the number and the size of trees, the character of ground—whether rough or smooth—intelligence of labor, accessibility of water, etc. There are, however, certain considerations which should receive attention in selecting an outfit, and there should be a better general knowledge of the principles of construction as affecting successful operation and preservation.

All pumps should have the working parts of brass or bronze or other substance which will not be corroded by the spray liquids. Brass valves are now used in the best class of pumps. Those of



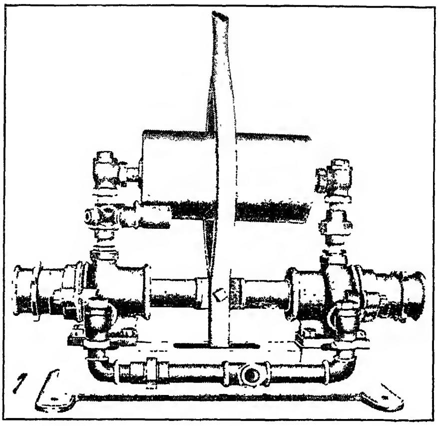
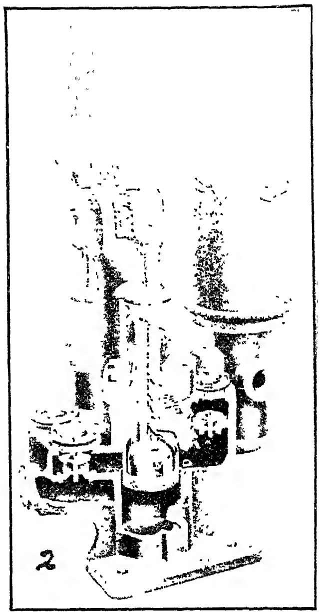
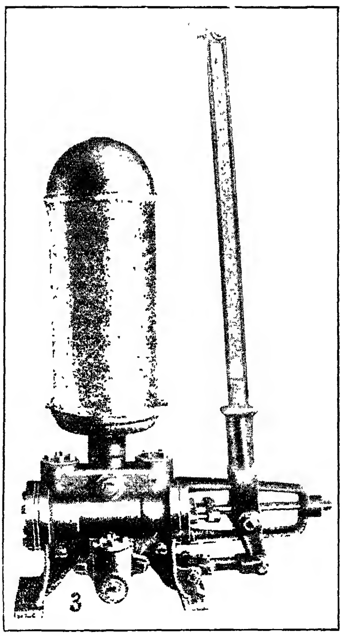
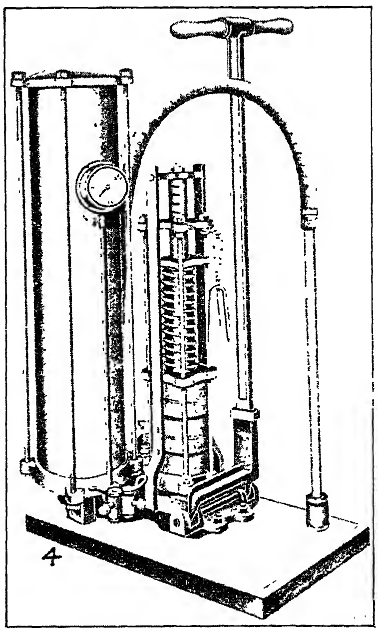






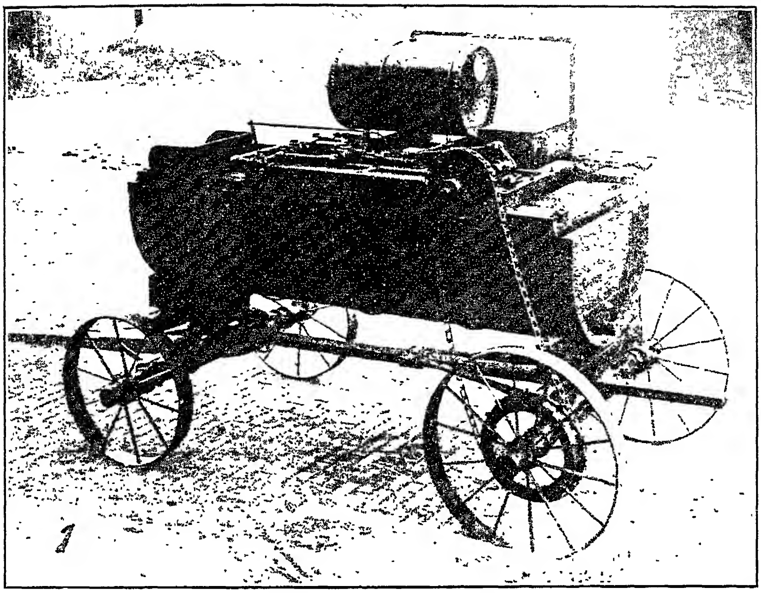
TYPES OF SPRAYING APPARATUS.

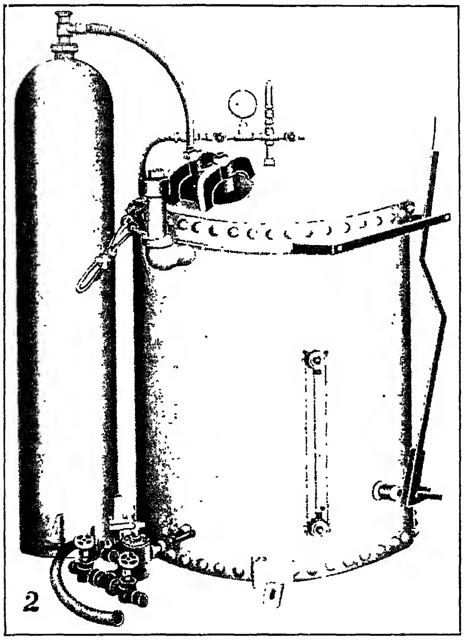
[Fig. 1.—Bucket pumps. Fig. 2.—Knapsack pump. Figs. 3 and 4.—Barrel pumps, showing also agitators.]

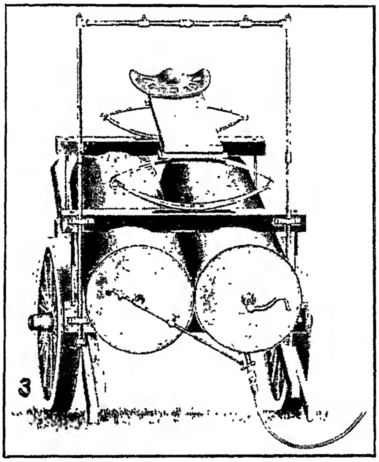





TYPES OF SPRAYING APPARATUS: HAND-POWER TANK OUTFITS.

[Fig. 1.—A double-acting, double-cylinder horizontal pump, with one-piece plunger. Fig. 2.—Sectional view of a double, vertical cylinder pump, showing plungers, valves, waterways, etc. Fig. 3.—A double-acting, single-cylinder horizontal pump. Fig. 4.—A hydraulic, single-cylinder pump with spring arrangement to lessen work in maintaining high pressure.]

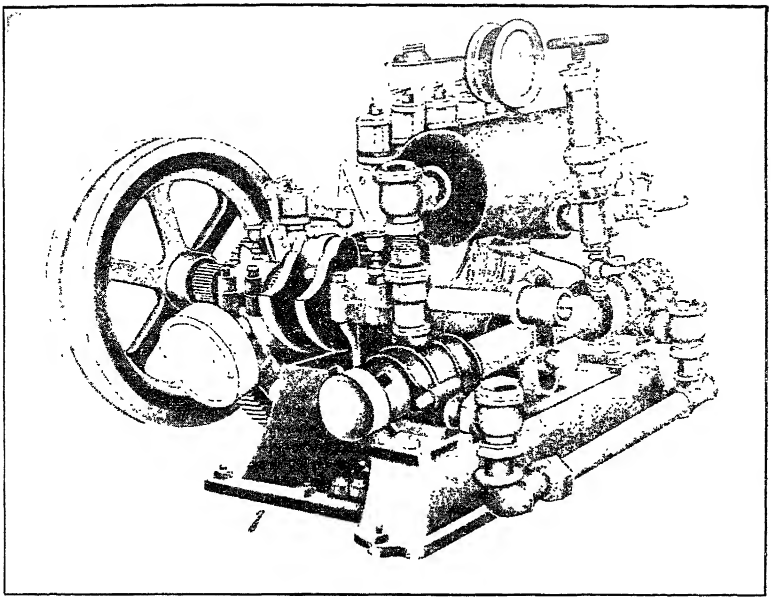


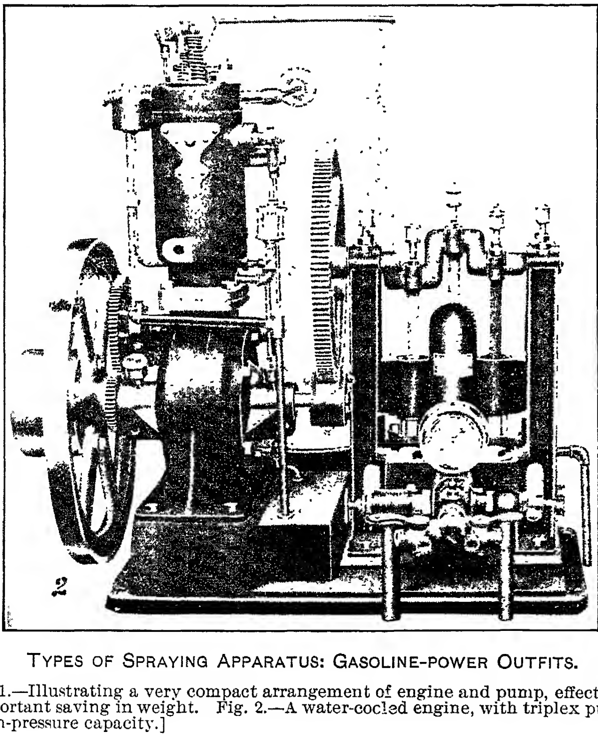




TYPES OF SPRAYING APPARATUS.

[Fig. 1.—Geared air-pressure outfit for orchard work. Fig. 2.—Carbonic-acid gas sprayer. Fig. 3.—Compressed-air sprayer.]





TYPES OF SPRAYING APPARATUS: GASOLINE-POWER OUTFITS.

[Fig. 1.—Illustrating a very compact arrangement of engine and pump, effecting an important saving in weight. Fig. 2.—A water-cooled engine, with triplex pump of high-pressure capacity.]

rubber or leather are objectionable, and pumps fitted with these will be a constant source of trouble.

Single-acting pumps are mostly used for barrel and smaller outfits. In the simplest of these there is but one set of valves, the cylinder being emptied and at the same time filled by the upward or backward stroke, the plunger returning through the liquid. The cylinders are either submerged in the liquid, being near the base of the barrel or tank, or are on the outside. The former are, on the whole, preferable as, being constantly covered with liquid, the valves may be made simpler, and hence not so likely to get out of order, and priming is unnecessary. Cylinders on the outside of the tank or barrel are often in the way, but are more readily accessible in case attention is required.

With true double-acting pumps liquid is taken in and discharged at each forward and backward or up and down stroke of the lever. Such pumps have one (Pl. XVII, fig. 3) or two (Pl. XVII, figs. 1 and 2) cylinders and are vertical or horizontal, mostly the latter in the single-cylinder type. Double-acting pumps are of large capacity, suitable for hand-power tank outfits or for gasoline, and with care last for several seasons.

In hydraulic pumps (Pl. XVII, fig. 4) the pump proper is connected with a large pressure tank into which the liquid is forced, the contained air forming an elastic cushion, the immediate source of power for forming the spray.

Bucket pumps.—This type of pump (Pl. XVI, fig. 1) is quite satisfactory where but a few small to medium-sized trees are to be treated. While somewhat inconvenient, on account of the necessity of carrying from place to place, this difficulty is not important in view of the small amount of work to be done. As a rule, sufficient hose is not supplied with bucket pumps for tree spraying. A hose 12 or 15 feet in length should be specified when ordering, and an extension rod is a distinct advantage (Pl. XX, fig. 17). Bucket pumps are suitable for applying any of the liquid sprays, as lime-sulphur wash, oil emulsions, arsenical poisons, Bordeaux mixture, etc. Several different forms are on the market, as furnished by different manufacturers. Sometimes pumps are furnished mounted on a galvanized bucket, but simply the pump can be obtained and use made of buckets or tubs already on hand. Some pumps also are fitted with clamps for fastening to the side of the bucket or other vessel. Good pressure may be developed with many of these, though usually two persons are necessary in their operation, one to pump and the other to handle the nozzle.

Knapsack pumps.—A knapsack pump (Pl. XVI, fig. 2), as the name suggests, is carried on the back of the operator, who pumps and directs the spray at the same time. The outfit consists of a copper tank (sometimes galvanized iron is used) fitted with a small pump, with handle attached, lead of hose, extension rod and nozzle, and straps for carrying. The tank holds about 4 gallons, and all classes of spray liquids may be applied. Knapsack outfits are often fitted for use as bucket pumps, by attaching a handle to the plunger. These were much used years ago in vineyards, and are still serviceable on hillside vineyards where it is impracticable to use a larger outfit, for small orchards of

young trees, etc. In commercial work, the knapsack has largely given way to the barrel pump, which for general work possesses many advantages. It is difficult to get necessary power with the knapsack outfit, it is rather heavy to carry, and especially disagreeable on account of frequent leaking around the pump or opening, which is very objectionable to the operator.

BARREL PUMPS.—The barrel type of spray pump (Pl. XVI, figs. 3 and 4) is more generally used than all others, and is especially suitable for small orchards, as up to 10 or 12 acres. A good barrel pump will supply adequate pressure for two leads of hose with double Vermorel or similar nozzles, and very effective orchard spraying may be accomplished. These are of many different forms, and there is considerable choice among the different makes. Some have the cylinders on the outside and others on the inside of the barrel, and, on the whole, the latter are preferable.

The pump is attached to the barrel either at the side or end, more commonly in the latter way. Side attachment, however, in some particulars is preferable, as the outfit is lower and less in the way and better agitation may be secured. The method of fastening of pump to barrel also varies. In some cases the pump may be removed simply by loosening a thumbscrew, catch, or similar device. Submerged pumps—that is, with the valves near the bottom of barrel and under the liquid—are mostly with short cylinders. These pumps are supported at the base on a short pedestal to raise the strainer somewhat from the sediment, or the base of pump may be raised some 8 to 12 inches from the bottom, the suction pipe, however, extending lower. Agitators are a very important part of any pump, and there are various styles on barrel pumps, as discussed under another heading. The barrel pump may be placed on a wagon or cart, or fastened to a sled or drag. One man is required to pump, who can also attend to driving, and one or two additional men, depending on whether one or two leads of hose are attached.

TANK OUTFITS.—In spraying on a large scale, and especially where water must be hauled some distance, 150 to 300 gallon tanks are employed. Half-round and rectangular tanks are made to replace the wagon bed on the trucks, and hogshead or square tanks may be placed at one end of the wagon on a platform, or in the wagon bed. Ordinary barrel pumps are used in some tank outfits, but mostly large, hand-working, double-acting, and double-cylinder pumps are employed, furnishing adequate pressure for two leads of hose and double or triple nozzles (Pl. XVII, figs. 1 to 4). These pumps are mounted on top of the tank, or on a platform at either end, and are provided with suction hose to be inserted into the spray tank. A common defect in tank outfits is lack of provision for adequate agitation. This point should not be overlooked by the prospective purchaser.

GEARED SPRAYERS.—In geared sprayers horse power is used to develop the pressure required to make the spray, the pump being operated usually by a chain connected with a sprocket wheel on one of the wheels of the wagon or cart. There is usually a pressure tank, the size depending upon the character of the spraying to be done.

In the orchard sprayer illustrated in Pl. XVIII, fig. 1, there is a single pump operated by a chain and sprocket wheel on the hind wheel of the wagon. Air is first pumped into the pressure tank, a drive of from three to five minutes sufficing to raise the pressure to from 20 to 25 pounds. The suction is then turned on the spray liquid, and a little further driving will raise the pressure to 80 or 100 pounds. The compression tank is large, holding about 20 gallons, and the pressure is said to be sufficient to thoroughly spray a tree while the

wagon is standing still. Driving from tree to tree accumulates additional pressure for further spraying. A better outfit of this type has two pumps with gearing on each hind wheel, materially adding to the pressure capacity. Geared sprayers are much used in vineyard spraying, and there are different styles of these on the market. Perhaps all of them are open to the objection that sufficient pressure can not be maintained without too fast driving for effective spraying. This style of sprayer is best suited for low-growing plants, as truck crops. For orchard spraying they are less reliable as to pressure than gasoline or steam power outfits.

Carbonic-acid gas sprayers.—Carbonic-acid gas under pressure in drums, as in general use, is being employed as a source of power in spraying. The pressure may be maintained quite uniformly and there is little about the apparatus to get out of order. It is perhaps somewhat more expensive than the gasoline or horsepower outfits, and one must be situated so that the drums can be promptly recharged and received without delay. A supply of several drums is an advantage, avoiding possible delay in spraying at critical times. These outfits are suitable for all classes of spraying with appropriate attachments, the spray tank and drum being mounted on a wagon, cart, or sled, as conditions require. Pl. XVIII, fig. 2, illustrates the tank, drum, and connections of a carbonic-acid gas sprayer.

Compressed-air sprayers.—Compressed-air sprayers embody the same principle as that employed in the carbonic-acid gas sprayers, and consist usually of two equal-sized cylinders—one the air chamber and the other for the spray liquid. The tanks are mounted together on a wagon or cart, with pipe and valve connections to regulate the pressure. The air is compressed in the air tank at a central pumping station, equipped with an engine and air pump and air-storage tank, at which time also the spray tank is refilled with the spray. This form of apparatus is very simple and excellent work may be done with it. While the initial expense is considerable, owing to the necessity for equipment of engine and air pump, this is more or less compensated for by simplicity of operation, as the spraying may be attended to by one man. In some outfits proper provision is not made for agitation, and in others this is provided for by introducing the air from the compression tank in jets on the lower side of the spray tank. (See Pl. XVIII, fig. 3.)

Steam-power outfits.—Outfits with steam for power preceded in point of time the gasoline outfit, but, owing to constant improvements, the latter are now in more general use. Nevertheless, some orchardists prefer steam outfits and are operating them with entire success. There are essentially two kinds of steam outfits used—one employing the steam pump and the other the steam engine; the latter makes the outfit somewhat heavier, but the engine can be used for various farm purposes. The principal objection to steam outfits is their weight. Either coal, wood, or petroleum is used for fuel, and this item of expense is small. Boilers of from 1½ to 2 horsepower capacity are used, the latter preferable as giving a certain excess of power, and mostly of the upright type. The prime requisites in the successful working of steam or gasoline outfits is to keep all parts in perfect working condition by frequent examination, adjustment, and repair if necessary. The packing of piston rod of pump is a frequent source of trouble, as it quickly wears out. Care must be used in the selection of packing material and to keep it properly lubricated. The oil cups must be watched to see that they are working properly, or else hot bearings and injury may follow. All dirt should be kept excluded and only the best grade of oil employed. During cold weather warming of oil is advisable to

insure its proper flow. Frequent cleaning of boiler of sediment and cakes is necessary, and the removal of soot from flues should be attended to every two or three weeks; otherwise there is an important loss of heat. The steam pressure should be maintained as uniformly as possible, and, also, the water level in the boiler should not vary much. The same care is necessary in the successful operation of steam sprayers as for steam engines in general, and aside from their weight, these give excellent satisfaction on account of their simplicity and reliability.

Gasoline-power outfits.—Gasoline engines have during the past few years been much improved and are coming into increased use for spraying and other purposes. As now furnished, many of these are quite reliable, and by reason of lightness and the small amount of attention required during operation are preferred to the heavier steam-power sprayers. Gasoline engines are either upright or horizontal, the former, as offered for spraying, usually of the marine-engine type and on the 2-cycle plan. (See Pl. XIX, fig. 2, showing upright engine and reduction gear connection to pump.) A horizontal engine with direct connection to horizontal pump is shown in Pl. XIX, fig. 1. In the latter there is a compact arrangement of parts, effecting a saving in weight. Engines with either water or air cooled cylinders are used in spraying outfits, the latter, as dispensing with the cooling tank, being lighter. No careful comparison of the upright and horizontal and of the 2 and 4 cycle engines, as used in spraying, has been made, but both have been used successfully for several years. The prospective buyer, perhaps, can not do better than to accept the statements of firms in whom he has confidence as to the satisfactory character of their equipment.

In the operation of gasoline engines care should be taken to avoid heating of the bearings from lack of sufficient oil and too tight adjustment. In case of failure of engine to work right, the batteries should be tested for sufficient current to fire the gas; the gasoline feed should next be examined, and the sparker to see that this is not gummed up. The presence of water or dirt in the gasoline often causes trouble. Back firing—that is, explosion and a jet of flame from air inlet—may result from bad mixing of air and gas, or, if during compression, to sparking at the wrong time. Leaky valves will be sure to cause trouble and require prompt attention. Frequent examination and cleaning of valves and sparking mechanism are essential, and attention must be given to the air supply. When the air and gasoline are properly balanced, there is complete combustion and but little, if any, smoke; too much gasoline is shown by the smoke, and if there is too much air the mixture fails to explode.

Any good power pump is satisfactory, but preferably the pump should be mounted on the same base with the engine, and direct connected, or with reduction or eccentric gearing. Most power outfits are now provided with relief valves for the return to the tank of liquid when pressure becomes too high, and also some automatic means of agitation of liquid in the spray tank. Despite efforts of manufacturers to reduce the weight of gasoline sprayers this is still undesirably great. Wide-tread wheels are used on the trucks, and the front wheels should be sufficiently low to permit short turns.

Dust sprayers.—Several machines are now made for applying insecticides and fungicides to plants in the form of a dust. Dust sprayers for orchard use have large capacity, and are operated either by hand or by gasoline engine. They comprise essentially a hopper containing the dust, and a strong fan for generating the air blast, which is conducted through a tube or chamber, into which the dust is automatically fed from the hopper, to be thus blown from the outlet tube upon the trees. In general, dust sprays as compared with liquid

sprays are considerably less efficient for orchard insects, and have but little value against fungi. On very rough ground or where there is not available water supply their use is perhaps warranted.

Nozzles.—The spray nozzle is an exceedingly important part of any outfit, and the orchardist can not afford to fit an otherwise good spraying outfit with any but the best nozzles. During the past fifteen or twenty years many styles of these have been offered, and for the most part these are referable to the following general types or classes, some falling with more than one class, according to the particular adjustment, as shown in Plate XX.

Figure 1 illustrates the primitive and simplest form, this being an ordinary hose nozzle, adjustable to make the stream coarse or fine. The water leaves the orifice as a solid round stream, and is broken into a spray by the action of the air, and a high pressure is required. Several nozzles in one of their adjustments have this method of forming a spray, but none having this as the sole method of spray formation is now used in orchard spraying. Nozzles of this type are useful in throwing liquids into high trees, though they are quite wasteful of the spray.

In figure 2 is shown another type of nozzle, the spray being formed by the impact of two converging streams of liquid. The spray is fan-shaped and at right angles to the direction of the two converging streams. Some of these, as shown in the figure, are provided with a metal strip with different-sized orifices.

The nozzle shown in figure 3 embodies still another principle. The stream leaving the outlet, strikes against a projection or interference attached to the nozzle, thus forming the spray. With some a thin metal strip is used, a piece of rubber, or, as in the example illustrated, a wire screen.

In the Bordeaux nozzle, shown in figure 4, the spray is formed by the action of the outlet. The orifice is made larger or smaller by turning the barrel by the projecting thumbscrew, varying from coarse to fine, and when the opening is clear a solid stream is formed, thus resembling the ordinary hose nozzle of the first class. The spray is fan shape, the nozzles are readily cleared, and this type is much used where a rather coarse spray is desired, as in reaching higher trees.

Figures 5 to 7 illustrate the well-known Vermorel type of nozzle, more used than all the other forms combined. There are many styles of these, but all more or less embody the principle of giving the stream a rotary motion before it leaves the orifice. There is a chamber or barrel with an inlet on the rim, and the liquid forced into the chamber is given an inwinding rotary course, and escapes from the central orifice on the disk in the form of a conical spray. In some types the rotary motion is induced by the direction given the inlet or by a spiral spindle in the chamber. In the nozzle shown in figure 8 the stream is given a rotary motion at the entrance orifice, and rotates against the disk.

Nozzle clusters.—Two or more nozzles are often grouped together, forming a "cluster," and with adequate power permit of rapid work. By varying the angle of the respective nozzles the spray may be made to cover a greater area. Various forms of attachments are offered, as a Y, or nozzles are attached to a tubular ring (see figs. 6 and 7). For ordinary orchard spraying the double or triple Vermorel nozzle is mostly used. Coarser nozzles, as the Bordeaux, are used in spraying lime-sulphur wash, where it is desired to thoroughly drench the trees, and also in spraying for the codling moth after the petals have fallen, as furnishing force to drive the spray well into the calyx cavities.

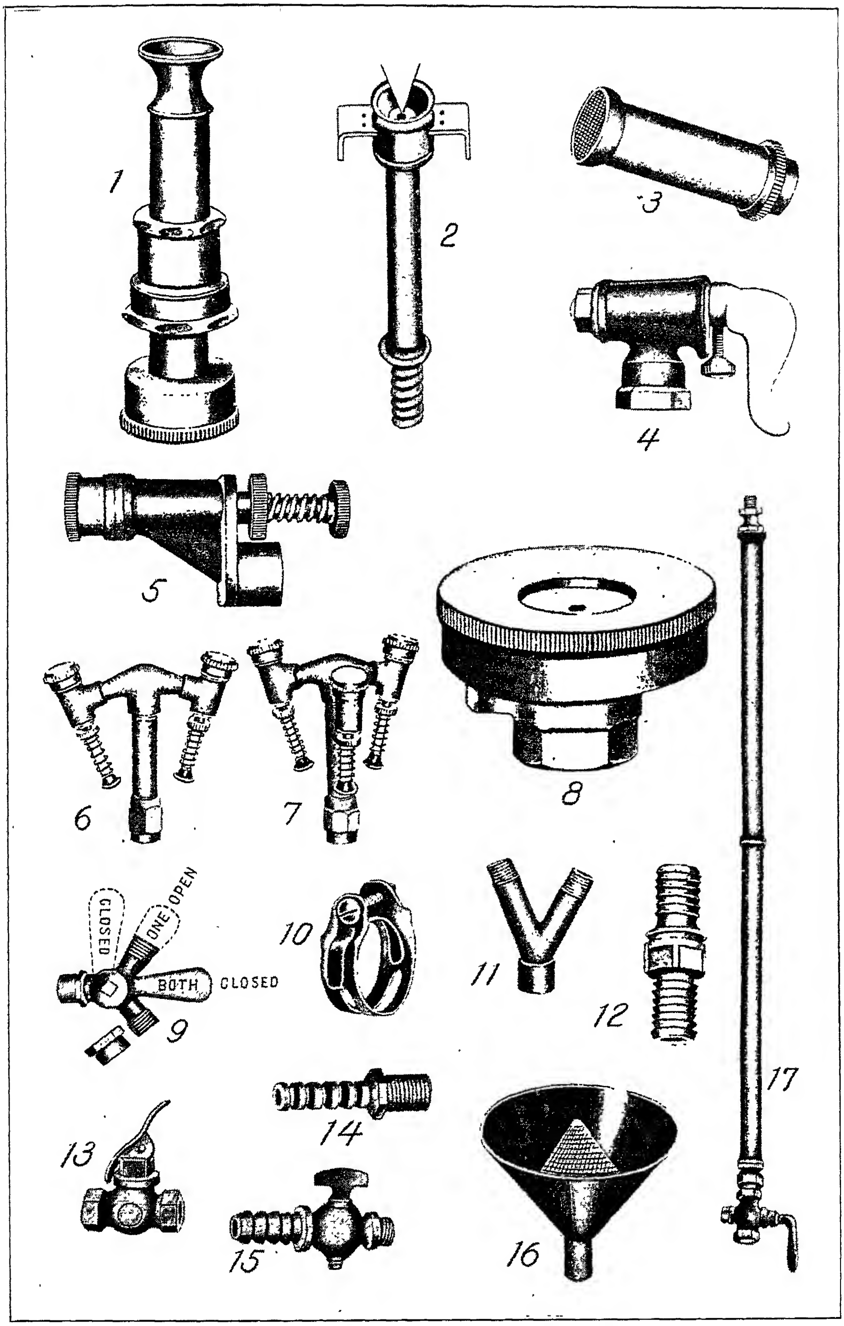
MISCELLANEOUS ACCESSORIES.—There are several accessories to spray-pump outfits, indispensable, or of great convenience. The Y discharge and shut-off, shown in figure 9, is convenient where it is desired to shut off one or both leads of hose temporarily. This is attached to the discharge of the pump, to which the hose is fastened with ordinary couplings. Stopcocks, as shown in figures 13 and 15, are very useful at base of bamboo rods to shut off the spray when not actually in use, as in going from one tree to another. Most bamboo rods (see fig. 17) are now provided with a shut-off, in which case these become unnecessary. The orchardist should keep on hand a supply of hose clamps and couplings (figs. 12 and 14), so that any trouble with these may be promptly corrected. Provision for straining the liquid as it is brought into the tank is indispensable. A strainer commonly furnished by dealers is illustrated in figure 16. An excellent form of strainer may be made at home in the shape of a box about a foot square, without top, and the bottom of heavy hard wood with a hole bored through the center of the bottom, in which is fitted a gaspipe 1½ or 2 inches in diameter and 8 or 12 inches long. A second and lighter box, open at the top, and with an overhanging flange all around as a support, is made to fit into the larger one. The bottom of the inner box is 18 to 20 inch mesh brass wire cloth and is made so as to slope at an angle of about 30°.

In orchard spraying, extension rods are indispensable to reach the higher parts of the trees. They are of two kinds—simply small gaspipe, or bamboo canes with brass or other tubular lining. The latter are light and are more largely used (see fig. 17). Extension rods are of various lengths, as from 6 to 16 feet, and should be ordered of sufficient length to do the work required. One end is usually supplied with cut-off valve, connecting directly with the hose, and the other with the nozzle attachment. Aside from their necessity in spraying tall trees, they are generally employed as better protecting the operator from the spray.

The hose supplied with many outfits is very unsatisfactory. One-half inch, 3 or 4 ply hose is mostly used, but a desired improvement is shown in that some dealers now furnish ⅝-inch hose and connections for power sprayers. The hose should have a safe excess of pressure capacity, and in any case should be capable of standing 200 pounds pressure per square inch. Some growers procure a cheap hose that will last merely through the season, buying a new supply from year to year. Others desire the best hose obtainable for use during two or more seasons. The length for working on the ground should be 25 to 50 feet, sufficient to permit spraying a tree from all sides before leaving it. The hose length for tower work may, of course, be much shorter, as 10 to 12 feet.

TOWERS.—In spraying high trees with whatever kind of outfit, as barrel, tank, gasoline, or other power, an elevated tower or platform built upon the wagon is very essential to thorough spraying. This should be from 4 to 6 feet above the level of the wagon bed, depending upon the height of the trees, the character of the ground, etc. With power sprayers, one man on the tower and two on the ground make an economical working arrangement.

TANKS.—Cypress, pine, or cedar wood makes the best tanks, the former being most durable. A coat of paint inside and out adds to their life and prevents the absorption of water, which would add to the general weight. Tanks vary from 50 to 300 gallons in capacity. If water is quite convenient, smaller tanks, as reducing weight, are advisable; but with inconvenient water supply, large tanks are preferable to obviate loss of time in hauling. Both upright and hori-



MISCELLANEOUS SPRAYING ACCESSORIES.

[Fig. 1.—Simplest type of nozzle. Figs. 2 and 3.—Other types of nozzles but little used in orchard spraying. Fig. 4.—The Bordeaux nozzle. Figs. 5, 6, and 7.—Illustrating the Vermorel type of nozzle much used in orchard work, and also illustrating nozzle clusters. Fig. 8.—A recent type of nozzle, similar to the Vermorel but of greater capacity. Fig. 9.—Cut-off. Fig. 10.—Hose clamp. Fig. 11.—Y for nozzle cluster. Fig. 12.—Hose coupling. Figs. 13 and 15.—Stopcocks. Fig. 14.—Nozzle connection. Fig. 16.—Strainer. Fig. 17.—Bamboo rod, with cut-off.]

zontal tanks are made, the former being either the barrel of 50 or the hogshead of about 100 gallons capacity. Horizontal tanks are either half-round or rectangular and may extend the entire length of the wagon or only about half this distance. The round-bottom tanks permit of short turning.

AGITATORS.—Practically all spray liquids rapidly settle in the spray tank upon standing, and provision must be made for agitation to insure uniform strength in the spray as applied. Careful attention should be given to this feature in any outfit. Mechanical agitators are of various kinds, referable mostly to (1) the dasher and (2) the whirling-paddle types. In the former, found mostly in barrel outfits, there is an up-and-down or lateral motion, or the lateral and vertical movements may be effected by the same agitator. These are mostly connected with the pump handle and are operated during the work of pumping (see Pl. XVI, fig. 3, showing a vertical-acting dasher type).

The second, or whirling-paddle types, are used mostly in tank outfits and are operated by hand or are connected by gearings with the wagon wheel. In power outfits an excellent arrangement is a shaft in the tank with necessary paddle wheels and connected with the engine. The liquid is given a rotary and upward movement, thoroughly mixing it.

A self-agitating, half-round tank is made by dividing it into three compartments by bulkheads, extending to within 6 or 8 inches of the bottom. The movement of the wagon in driving forces the liquid along the bottom and upward against the bulkheads and ends of the tank. Some half-round tanks are provided with a series of equally spaced paddles, fastened together above with strips, and extending along the bottom of the tank. The whole is moved back and forth horizontally by a handle on the outside.

In the jet agitator a portion of the spray liquid under pressure is returned to the spray tank, entering at the bottom. This style is but little used, except where abundant power is available, as in gasoline or steam outfits.

APPLICATION OF SPRAYS.

Successful spraying must be based upon a knowledge of the habits of the pests to be controlled. Entomologists and plant pathologists have indicated the kind of spray to be used, the times, and manner of applications, for the principal orchard and vineyard troubles; and for some crops, as apple and grape, schedules of application have been given to furnish protection against the principal insect and fungous troubles. Growers have not by any means taken proper advantage of these recommendations, and much careless and ineffective spraying is seen where better work would be expected. From a business point of view, the fruit grower can not afford to ignore the details of this highly important feature in orchard work. Apparatus should be overhauled in ample time before it is needed for use, chemicals gotten in stock, and all arrangements made, so that when the time for spraying arrives there will be no delay.

In the actual operation of spraying, account must be taken of the end desired. Thus, in dormant-tree spraying, as for the San Jose scale, every part of the tree from top to bottom should be reached. In spraying for the codling moth after the petals have fallen, the

object is to place poison in each and every calyx cup, and frequent examinations of sprayed fruit clusters should be made to see that this is being properly accomplished. In spraying for leaf-eating insects in general, a mistlike spray is desired and a general distribution over the tree must be effected. Correct spraying is really an art, and, while ideally perfect work is rarely accomplished, any orchardist by proper care can acquire a sufficient degree of proficiency to secure entirely satisfactory results.

THE SO-CALLED CHANGE OF CLIMATE IN THE SEMIARID WEST.

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VASTNESS OF THE ATMOSPHERE AND PERMANENCE OF CLIMATE.

The atmosphere, in constant motion over land and water surfaces, expanding and contracting with heat and cold, absorbing moisture in one region to precipitate it in another, and swirling into valleys and over mountain ranges, resolves the peculiarities of its lower levels into a general average that we call climate. It gives marine climates to oceans and contiguous territory and continental climates to the great interiors.

Climates originated in the adjustment of the primitive atmosphere to the ancient geological surfaces during the early period of world making, and climatic changes have been as numerous as the epochs in geological history. But these changes occurred ages upon ages ago—so long ago, indeed, that the lapse of time must be measured in tens of thousands or in millions of years. If the ancient ancestors of the mound builders could be aroused from their slumbers their medicine men would relate a hoary legend to the effect that the waters of the southern seas once tossed over the western plains and the great Southwest and washed the feet of the Rockies. It is said that Greenland, in the process of construction of the earth's crust, is rising at the rate of 1 foot per century. No climatologist, however, has had the hardihood to assert that any appreciable change in the climate of Greenland could be detected at the end of the longest lifetime, or even at the close of a millennium. Aristotle, the sage, one of the greatest of scientific observers, flourished about two thousand three hundred years ago; since his day there have been many scientific observers; yet in all these years there has been no record of a permanent change of climate in any part of the known world.

SUPERIORITY OF RECORDS OVER MEMORY IN DISCUSSING CLIMATE.

Notwithstanding these and other evidences that have been published from time to time, nearly every community in the semiarid West contains a few individuals who are repeatedly affirming that certain sections may safely expect an annual precipitation greater by 5 or more inches than the precipitation of twenty, thirty, or forty years ago. How do they know? In fact, they do not know; they rely upon recollection. But the man with $1,000 to invest in farm land and the bank that assists him in carrying a larger proposition are unwilling to accept recollection as collateral and come to the Weather Bureau for proof. In any such case the Weather Bureau,

after investigating the records, makes a careful statement showing that climates do not perceptibly change and warning the prospective investor and his financial backer that they should have complete knowledge of the climatic conditions that will likely surround the locality in question. We know that the meteorological records of the world, covering several hundreds of years, show recurring periods of dry and wet weather, ranging from periods of ten or eleven years to still greater stretches of thirty-five or thirty-seven years, followed by periods of contrary conditions.

When such a statement is made, however, there arises a host in protest, without record, relying upon memory, uppermost in which is the abnormal of bygone times, and declaring that the climate has changed permanently. Here and there a man will affirm that a correct statement of facts by Government officials hurts his business. The natural reply is, "How about the man with $1,000 to invest in land, and the bank that advances him additional money?" Everybody knows that memory is defective.

A casual comparison of values in the diagram (fig. 2) and tables that have been prepared with a view to illustrating the variations in annual precipitation, wind velocity, and relative humidity (see tables, pp. 294, 295) during the period in which the acreage of semiarid lands has been very largely increased will plainly show that it is beyond the capacity of the brain to retain details of weather without record.

INSIGNIFICANCE OF MAN'S INFLUENCE UPON CLIMATE.

Western Asia, northern Africa, and portions of North America were called deserts in remote ages, and we still believe they will continue deserts during the vast periods of time to come. The Chaldeans, ancient Persians, Ninevites, and Egyptians exerted untold effort in producing verdure that succeeding peoples have allowed to disappear before the blistering desolation. Geological evidence shows that extensive forests once flourished in these regions, and remains of highly creditable irrigating works have lately been discovered in the Arizona desert. But man's efforts did not change the climate in these regions. When his efforts ceased, the desert reoccupied the territory which he had for a time subdued to his needs.

The earth's atmosphere is pressed downward by gravity, so that about one-half its mass is confined below an elevation of 18,000 or 19,000 feet above the surface of the sea, although its total depth is 100 miles or more. Practically all life is propagated in the lower half of the atmosphere; and while the upper half flows constantly from the west toward the east, the lower half flows in great eddies or whirls, sometimes about a center where the air presses downward more than the average, when the direction of motion will be the same as for the hands of a watch, and sometimes about centers where

the air presses downward less than the average, when the motion will be in the opposite direction. The eddies about centers of increased or "high" pressure are called anticyclones, while eddies about centers of diminished or "low" pressure are called cyclones. These eddies of the lower atmosphere raise the dust from the land into the upper atmosphere, where it is sometimes carried great distances. South American dust has been found in Africa. The red rain in Italy and Germany during March, 1901, was caused by red dust transported northeastward during an Algerian cyclone. The volcanic dusts from the crater of Krakatoa, Sumatra, in 1883, which were distributed through the atmosphere by the winds, caused the great sunset glows throughout the world in 1883, 1884, and 1885.

If we can imagine a great cyclone affecting the country from the Atlantic to the Pacific over an area of 3,000,000 square miles, such as the great storm of 1889, originated by the intermingling of masses of warm air from the equator and cold air from the pole, and which cover a greater extent of the earth's surface than the territory of the United States, and then imagine the influence of any semiarid State lying in the pathway of such a disturbance, we can understand that a whole series of States, much less the man with his plow, is unable to control climate. The semiarid States are contending against stupendous forces in the form of the great air currents, which are charged with billions of tons of moisture and dust before they come within a thousand miles of the Middle West. Each State contributes its proportion of dust and moisture to the general air mass as it proceeds eastward, and these are carried away with the speed of the winds blowing at the time. It is evident, then, that the cultivation and forestation of the semiarid region, even though they had proceeded much farther than they have, could not change the climate.

The density of population in the Central States, with total acreage of improved and unimproved farm lands, taken from the census of 1900, is as follows, in round numbers:

Density of population and acreage of farm lands in the Central States.

State.	Average number of inhabitants to the square mile.	Improved farm land.	Unimproved farm land.
		Acres.	*Acres.*
Colorado	5	2,000,000	6,000,000
Illinois	86	27,500,000	5,000,000
Indiana	70	17,000,000	5,000,000
Iowa	40	29,000,000	4,500,000
Kansas	18	25,000,000	17,000,000
Kentucky	54	13,000,000	9,000,000
Missouri	45	22,500,000	11,000,000
Nebraska	15	18,000,000	11,000,000
Ohio	102	18,500,000	5,500,000
Oklahoma	10	6,000,000	10,000,000

In spite of the great differences in density of population and in the proportion of land improved, the records show that no single part of the areas mentioned, or any other part of the vast territory remaining in the country, has been exempt from droughty periods.

VIEWS OF AUTHORITIES AS TO CLIMATIC CHANGES.

Prof. F. M. Ball, of the University of Minnesota, in a paper published in the Monthly Weather Review for May, 1906, says in reference to the various reasons given for so-called changes in climate:

That seemingly most lawless of all elements, the wind, is no less under the direct control of law and responds to it with no less unhesitating obedience than does the earth to the law of gravity in its yearly swing around the sun.

Speaking generally, we may say that any climate is determined by the following factors:

First—Distance from the equator.

Second—Elevation above sea level.

Third—Distances from large bodies of water.

Fourth—The character and arrangement of surface features.

Fifth—The direction of the prevailing winds.

Sixth—When long periods of time are concerned, the distance of the sun from the earth and the attitude of the hemispheres of the earth to the sun during aphelion and perihelion.[a]

Seventh—The relative amount of carbon dioxid present in the atmosphere (a very important element in connection with plant and animal life).

Of these elements only the fifth is considered variable during periods measurable by man. * * * A study of cyclonic circulations will bring the conviction that these, too, are subject to law as rigid as the permanent trades and westerlies.

As far as shown by the facts which are at hand, we must conclude that all climates that have been scientifically observed remain invariable.

Prof. W. M. Davis, of Harvard College, says:

It is a popular notion that our climate is changing. * * * These errors arise * * * from natural exaggeration of past events and from a disposition to forget facts of ordinary value and remember exceptional occurrences. * * * It is true that slight fluctuations of rainfall and temperature in nearly eleven years, corresponding to the sun-spot cycle, have been made out at certain stations for a moderate number of periods. A longer variation is indicated * * * in other countries in a period of thirty-six or thirty-seven years, * * * but at least another century will be needed to confirm this result and extend it over the world.

Dr. Julius Hann, professor of cosmical physics, University of Vienna, and editor of the Austrian Meteorological Journal, in his Handbook of Climatology, says:

The United States seem to offer the most favorable conditions for answering the question as to the extent to which increasing cultivation of large districts of country may result in change of climate. In the East there has been an ex-

[a] During our winters, or when the northern hemisphere is turned away from the sun, the earth is at a point in her orbit nearest the sun, or at perihelion; and for several thousands of years we shall continue to have short winters and long summers. The converse is true of the southern hemisphere. It would require 5,000 or 10,000 years to make a change in the seasonal position of the earth in her orbit sufficient to produce a noteworthy difference in climate.

traordinary decrease * * * in territory formerly covered by forests; while, on the other hand, a good deal of planting has been done on the western prairies and plateaus. No corresponding change in temperature or in precipitation has, however, thus far been demonstrable.

Brückner's oscillations of climate help to explain the prevailing views, which are so often contradictory, of a change * * * for better or worse to a moister or drier condition. Such views have grown up as the result of impressions made by different phases of these oscillations. The improvement in climate in the western portion of the United States has been associated with a wet period of climatic oscillations. A drier phase, which began about 1886, ended this, as has been the case in Egypt and Siberia. Continental areas are just the ones most markedly affected by these changes. Brückner expresses no opinion concerning the causes for this thirty-five-year periodicity in climatic oscillations. He is properly content with having demonstrated the existence of the period with a high degree of probability.

Prof. Willis L. Moore, Chief of the U. S. Weather Bureau, says:

It is my duty to publish the simple, ungarnished facts in regard to the climate of the United States. Our people want the truth so that they may not be misled by those who honestly, but nevertheless ignorantly, claim that hot winds and droughts will never come again; or by those who, when periods of deficient rainfall come, as they have in the past and as they certainly will in the future, preach discouragement and the abandonment of lands which, on the average of a long period of years, it would be profitable to cultivate.

I have made careful examination of the Government records, with a view of putting before those interested in the matter a correct statement regarding the rainfall and wind of both Kansas and Nebraska. * * * The Government records, as is well known, are in a class separate and distinct from the recollections of the oldest inhabitants. * * *

Mean rainfall at the stations named.

Station.	Period of observation.	For the full period of observation.	For the thirty years 1877–1906, in periods of ten years.			
			First.	Second.	Third.	Mean.
		Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
Denver, Colo	1870–1906	14.0	14.5	13.4	13.4	13.8
Dodge, Kans	1875–1906	20.8	22.8	18.4	22.7	21.3
North Platte, Nebr	1875–1906	18.7	20.1	17.2	19.8	19.0
Independence, Kans	1872–1906	37.1	39.1	35.5	38.1	37.6
Genoa, Nebr	1875–1906	28.2	26.3	26.4	31.3	28.0
Manhattan, Kans	1858–1906	30.6	33.4	29.2	31.9	31.5
Lawrence, Kans	1868–1906	36.4	35.1	39.2	36.7	37.0
Omaha, Nebr	1871–1906	30.7	37.6	25.6	27.9	30.4
Minden, Nebr	1878–1906	31.5	36.1	29.2	29.8	31.7
Oregon, Mo	1866–1906	35.6	37.1	32.3	39.5	36.3
Keokuk, Iowa	1872–1906	35.0	35.4	31.4	35.1	34.3

The averages in the periods of ten years each appear in the table, from which it may clearly be seen that the first and last ten years were periods of fairly abundant rainfall, and the middle ten years was a period of deficient rainfall.

The heavy rains of 1906, and also the year previous, were common to all that vast stretch of territory west of the ninety-fifth meridian. It was not a local phenomenon centered in western Kansas and western Nebraska, since equally heavy rains fell in Colorado, Utah, western Texas, Oklahoma, New Mexico, Arizona, Nevada, and central and southern California.

WHAT THE RECORDS SHOW.

That there has been no permanent change in wind velocity, rainfall, or relative humidity of the atmosphere is amply shown by the tables following, which give the significant facts for ten stations in the semiarid region during the period in which records have been made.

Wind velocity, precipitation of moisture, and relative humidity of the atmosphere in the Plains States, showing how changes in one period of years may be offset by those of a following period.

WIND VELOCITY.

Station.	Length of period in which records have been made.	Total wind movement in a year (average for the whole period).	Average velocity per hour (for whole period).	Average difference in velocity per hour between the whole period and the period— 1889–1898.	1899–1907.	1889–1907.
	Years.	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*
Amarillo, Tex.	16	130,415	15	+2	−1	0
Bismarck, N. Dak.	34	84,528	10	0	0	0
Concordia, Kans.	23	67,220	8	0	0	0
Dodge City, Kans.	33	101,595	12	0	−1	0
Huron, S. Dak.	26	101,592	12	0	0	0
North Platte, Nebr.	33	86,032	10	0	−1	0
Oklahoma City, Okla.	17	95,023	11	−1	+1	0
Omaha, Nebr.	37	[a]72,576	[a]8	0	+1	0
Rapid City, S. Dak.	20	71,780	8	+1	−1	0
Wichita, Kans.	19	79,135	9	0	0	0
Average for the 10 stations	....	88,990	10	0	0	0

[a] Average for 36 years.

PRECIPITATION OF MOISTURE.

Station.	Length of period in which records have been made.	Days with 0.01 inch precipitation each (average number per year). Average number for the whole period.	Average difference in number between whole period and period— 1889–1898.	1899–1907.	1889–1907.	Days with 0.04 inch precipitation each (average number per year). Average number for the whole period.	Average difference in number between whole period and period— 1889–1898.	1899–1907.	1889–1907.
	Years.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
Amarillo, Tex.	16	77	[a] +7	− 6	0	57	[a] +1	−2	0
Bismarck, N. Dak.	34	98	−5	−16	−10	....	......	......	......
Concordia, Kans.	23	82	+3	+ 7	+ 5	64	−1	0	0
Dodge City, Kans	33	75	−1	+ 3	+ 1	55	−1	0	0
Huron, S. Dak.	26	98	−2	− 5	− 4	64	−1	−4	−2
North Platte, Nebr.	33	81	−3	+ 2	0	58	−4	+6	+1
Oklahoma City, Okla	17	84	[b] +3	− 3	0	64	[b] +2	−3	0
Omaha, Nebr.	37	102	−6	− 3	− 4	73	−5	+2	−2
Rapid City, S. Dak.	20	98	+5	− 7	− 1	62	−6	+4	−1
Wichita, Kans.	19	86	−3	+ 4	0	66	−2	+3	0
Average for the 10 stations.	....	88	0	− 2	− 1	63	−2	+1	0

[a] Record, 1892–1898. [b] Record, 1891–1898.

Wind velocity, precipitation of moisture, and relative humidity of the atmosphere in the Plains States, etc.—Continued.

PRECIPITATION OF MOISTURE—Continued.

Station.	Length of period in which records have been made.	Days with 0.25 inch precipitation each (average number per year).				Days with 1 inch precipitation each (average number per year).			
		Average number for the whole period.	Average difference in number between whole period and period—			Average number for the whole period.	Average difference in number between whole period and period—		
			1889–1898	1899–1907	1889–1907		1889–1898	1899–1907	1889–1907
	Years.	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*	*Days.*
Amarillo, Tex	16	24	[a]−1	+1	0	5	[a]−1	+1	0
Bismarck, N. Dak	34	....	......	......	......	....	......	......	......
Concordia, Kans	23	28	0	+4	+2	7	0	0	0
Dodge City, Kans	33	22	−1	−2	−2	5	−1	0	0
Huron, S. Dak	26	23	−3	−2	−2	4	0	0	0
North Platte, Nebr	33	21	−3	+3	0	3	0	0	0
Oklahoma City, Okla	17	33	[b]0	0	0	9	[b]0	0	0
Omaha, Nebr	37	34	−5	+1	−2	7	−1	−1	−1
Rapid City, S. Dak	20	20	−3	+3	0	3	−1	0	0
Wichita, Kans	19	34	−1	+1	0	8	0	+1	0
Average for the 10 stations	....	27	−2	+1	0	6	0	0	0

[a] Record, 1892–1898. [b] Record, 1891–1898.

RELATIVE HUMIDITY OF THE ATMOSPHERE.

Station.	Length of period in which records have been made.	Annual average for the whole period.	Difference in annual average between whole period and period—		
			1889–1898.	1899–1907.	1889–1907.
	Years.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Amarillo, Tex	16	62	[a]−4	+2	−1
Bismarck, N. Dak	34	[b]70	0	−1	0
Concordia, Kans	23	70	−1	+2	0
Dodge City, Kans	33	[c]66	−2	+3	0
Huron, S. Dak	26	[c]72	−2	+1	0
North Platte, Nebr	33	[d]68	−2	+2	0
Oklahoma City, Okla	17	73	[e]−2	+2	0
Omaha, Nebr	37	[c]69	−1	+2	0
Rapid City, S. Dak	20	[c]62	−4	+4	0
Wichita, Kans	19	69	−1	+1	0
Average for the 10 stations	....	68	−2	+2	0

[a] Record, 1892–1898.
[b] Average for 27 years.
[c] Average for 19 years.
[d] Average for 20 years.
[e] Record, 1891–1898.

QUANTITY OF MOISTURE.

The Colorado River did not break through its banks and form the Salton Sea until after the heavy rains of early 1905. Prof. Alfred J. Henry has shown that in this case many people have substituted the effect for the cause. He estimated that it would require the volume of twelve Salton seas to produce the surplus rains of 1905 in Arizona alone, which ranged about 15 inches above the normal of 12 inches.

The eastward drift of all storms, and the increasing elevations eastward from the Mississippi, made it possible for extensive forests to flourish in that region. But the vast area under the lee of the Rocky Mountains receives its moisture from the western storms after they have precipitated much of their water content on the higher elevations and before they have been replenished by fresh moisture-laden winds from the Gulf of Mexico.

The buffalo grass, eking out its living on an inch or two of parched plain under an occasional rain, was too dry to produce dew, except well toward morning, and then only under the most favorable conditions. The imported species of grasses, planted in deep-plowed soil, go down and bring up conserved moisture, throwing their whole bodies to the air and presenting cool surfaces for the deposition of dew, while the flattened bodies of their cousin are stunted from lack of moisture.

So the grass has spread, and the orchard and shade trees have outstripped their suffering brethren on the dry run. The shack of the young pioneer gave way to a comfortable home as he made headway against his difficulties. The receptive surface of the newly cultivated farm allowed the moisture to percolate into what was once a sun-baked desert. At the spot upon which each leaf fell from the trees the evaporation ceased in proportion as it had gone on untrammeled before. The rigors of climate have been overcome by man, and the last twenty-five years have inclosed numerous plains cities in copses of trees surrounded by some of the most valuable farm lands in the world.

It is the man that has changed, not the climate, and the face of nature has changed with efforts far exceeding those of the early eastern pioneers. The western man who has observed the wilderness blossom as the rose decries his own power when he charges to the account of change of climate the blessings resulting from his own initiative. It required much more than the buzzing of the drones while the climate was "changing" to make orchards, meadows, grain fields, and vineyards in Oklahoma, Kansas, Colorado, Nebraska, and the Dakotas. Perseverance placed the city of Denver on the site of the Indian tepee in the valley of the upper Platte, and "change of climate" did not plant Salt Lake City in the deserts of Utah.

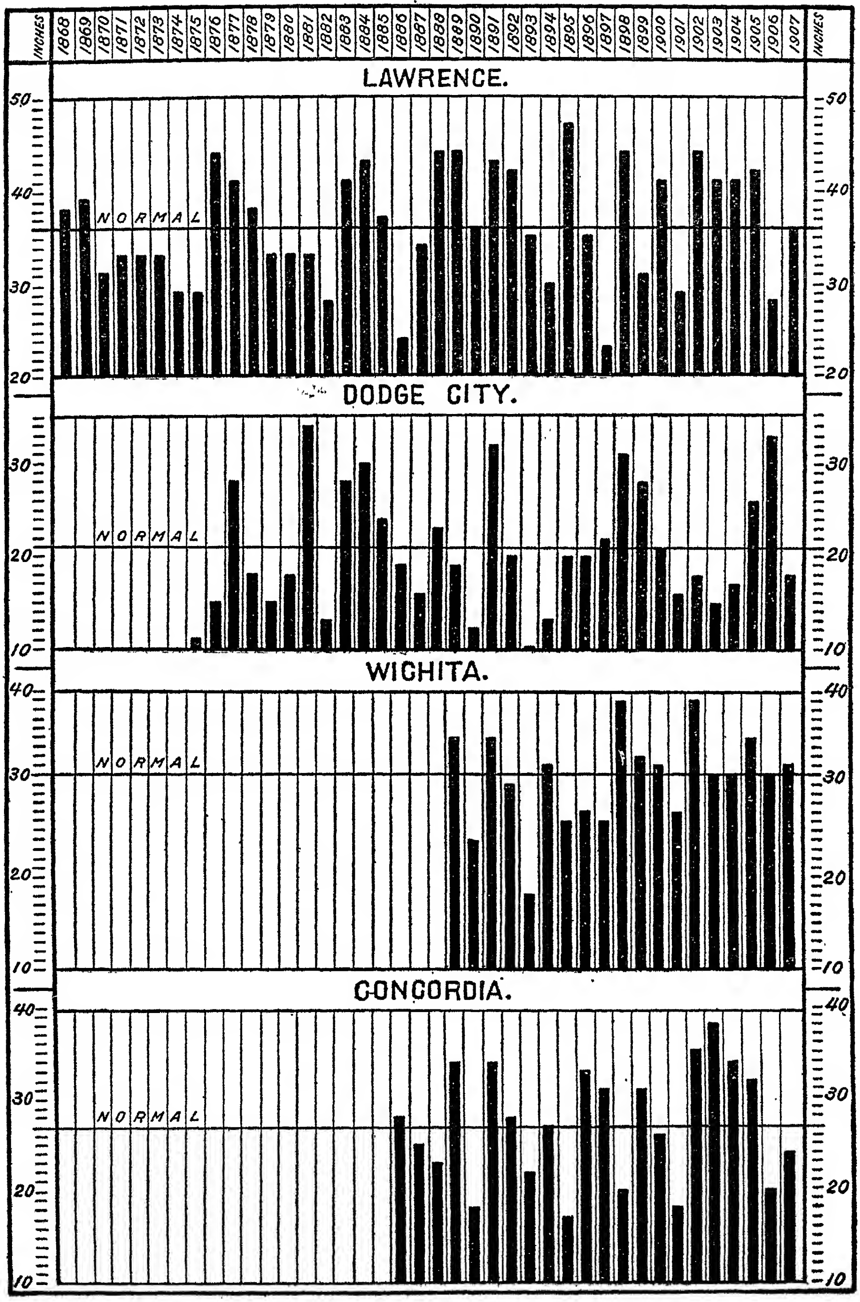

FIG 2.—Variations in annual precipitation at Kansas stations.

The present-day western cornfield is not like its grandfather of thirty years ago and not like the present-day cornfields of the Ohio Valley States. The difference is due simply to the fact that the latter region receives 10 to 15 inches more rainfall annually than the semiarid West, where the agriculturist has learned to govern his cultivation according to this deficiency. Thirty years ago there was no system of dry farming. As the old sod plow and the wood-tooth rake have given way to modern farming implements, so have the vast majority of farmers discarded antiquated methods for those best suited to the climatic surroundings.

Therefore, we need not say that the western country will revert to its former condition as a buffalo range and that the hardships and isolation of the pioneers will come again. Perish the thought! But we must say that dry seasons will inevitably recur in the semiarid States, just as they have recurred even in the East, where abundant rainfall may reasonably be expected.

One argument is that the increased irrigated area in Colorado has caused changed conditions there and in Kansas as far as the rainfall is concerned. The records at Denver and Dodge City prove the contrary.

Another is that the winds of earlier days were more violent and twice as high as at present; that they plowed "shallow" to kill the prairie sod, and that it was not until they began to plant trees and hedges and to till the soil, so that weeds and stubble could hold the water back, that they got full benefit of the rains. If the argument stopped at this point there could be no dispute, except as to wind velocities, which all the records prove were not twice as high, although the winds have not lately been as high as in individual years of former times. But it is also asserted that the moisture, with the consequent growth of vegetation, has served to modify the climate and make it more uniform, both as to rain and temperature and as to crop returns. The rain and temperature proposition is disproved by the facts presented herewith. The crop results indeed are now greater than ever before, but this is due to improved farming methods, which provide for the conservation of moisture during abnormally dry seasons and the disposition of surplus moisture during the wet periods.

Droughts, hot winds, and high temperatures are not impossible in any section at any time. Francis Parkman says that during the summer and fall of 1764, at the time of Pontiac's war, a great drought prevailed over the region north of the Ohio River, and British soldiers suffered great hardships in navigating the streams. Yet the settler had not then had much chance with his ax, and the lands were covered with an interminable forest.

Prof. Alfred J. Henry, in Climatology of the United States, says:

The greatest drought this country has experienced in the last one hundred years, both as to intensity and extent of territory covered, culminated in the middle Mississippi and Missouri valleys in 1894, and in the Lake region and Atlantic coast districts in 1895. The drought of 1894 was the culmination of a period of deficient precipitation and high temperatures that began during the early summer of 1893. The subsoil from which the surface soil, by capillarity, draws a portion of its moisture had become appreciably desiccated, and the way was open to a disastrous drought should the spring and summer rains fail.

In September, 1908, the Susquehanna River was lower than it had been in more than one hundred years, and instances were published of boys playing ball in the river bed of the upper Ohio.

In the Middle States, as well as the entire region between the Rocky Mountains and the Mississippi River north of Texas, the great hot wave of July, 1901, broke records in many sections, the temperatures ranging from 109° to 116° in the shade. These figures were published by the Weather Bureau at the time, and clearly show that abnormally high temperatures or hot winds are not confined to any particular locality.

In looking over the published reports we find that heavy rains and floods occurred in some portion of the Plains States in 1785, 1811, 1826, 1844, 1845, 1851, 1877, 1903, 1904, 1907, and 1908. At Fort Leavenworth during the three months of June, July, and August, 1844, nearly 29 inches of rain fell, while the annual normal is only 31 inches. In June, 1845, over 15 inches fell at the same station, and in May, June, July, and August, 1851, nearly 27 inches were measured. The great floods of 1903, 1904, 1907, and 1908 from the Missouri River watershed and adjacent slopes were undoubtedly more disastrous than former inundations on account of the vast quantity of valuable property involved. Mr. J. R. Mead, an old settler, who is well known as an early trader among the Plains Indians, recently stated to the writer that the pioneers suffered nearly as much from floods as they did from drought and that a very large proportion of the heavy rains rushed over the hard surfaces into the runways, inundating what little cultivated ground there was in the bottoms. While floods still occur, a much greater percentage of the heavy rains is conserved in the largely increased acreage of cultivated lands, not only in the valleys, but also on the open prairies.

TEMPERATURE.

French records dating into the fourteenth century show nothing more than periodic variations in temperature. During the one hundred years 1775–1875 the average vintage date at Aubonne was ten days earlier than during the two preceding centuries, and now it is the same as in the sixteenth century. Similar data at Dijon show a range

in the vintage date of not over five days, October 25–30. The mean temperatures of stations scattered over the entire world show warm periods during the past century as follows: 1791–1805, 1821–1835, and 1851–1870, with cool periods between the series. The variations in climatic temperatures for the whole world do not range more than 1° on either side of the true mean, and the same relative values will apply to the United States, with a somewhat more pronounced change in the Plains States. In Oklahoma the range from the 15-year normal is −1° to +2°; Kansas, 21-year normal, −1° to +2°; Nebraska, 32-year normal, −2° to +3°; South Dakota, 18-year normal, −3° to +4°; North Dakota, 16-year normal, −2° to +3°.

With few exceptions March, 1906, was the coldest March in the middle Plains States for forty years; and March, 1907, the warmest, followed in April and May by the most disastrous killing frosts ever experienced by orchardists. January, 1907, was the coldest January in Montana and North Dakota in fourteen to seventeen years. Records for the past one hundred and twenty-two years at Boston show but five Februarys colder than February, 1907. Several well-known citizens of Wichita traveled 1,700 miles from snow in Kansas to witness the first snowstorm in fifty years in the City of Mexico during the winter of 1907. Records at Leavenworth since 1832 show a minimum of −30°, and minima of −10° to −29°, according to latitude, have not been at all uncommon in the semiarid States within the last forty years. The great North American cold waves over the eastern slopes of the Rocky Mountains still maintain their old-time vigor in season. As a particular instance, on March 2, 1904, the temperature at Wichita fell from 80° at 5 p. m. to 12° above zero the following morning. The dwellers on the steppes of Russia still experience similar rapid and widespread changes in temperature in season.

CONCLUSION.

We are led to the conclusion that the so-called changes in climate have been nothing more than irregular oscillations; that a succession of dry years has given way to recurring wet years; that there are alternating series of warm and cool years; that thus far there are imperfect seasons of maximum winds attending low-latitude storm movements, with turns to minimum winds attending high-latitude storm movements; that droughts are possible in any part of the country at any time, winter or summer; and that it is beyond the power of memory even to chronicle the abnormal in weather, without considering its application to climate.

MOUSE PLAGUES, THEIR CONTROL AND PREVENTION.

By Stanley E. Piper,

Assistant, Biological Survey.

INTRODUCTION.

Swarms of mice devastating the fields have been seen by very few American farmers, but such scourges are among the oldest and most disastrous known in history. Regarded with wonder and superstitious awe in early times, and still looked upon in some countries as miraculous, outbreaks of field mice are fraught with such dire consequences to agriculture as to have earned the name of plagues. In Europe and Asia mice have often almost completely destroyed crops over areas varying in extent from thousands of acres to whole provinces. Practically all vegetation suffers from their attacks. Pasturage, hay, alfalfa, clover, grain, whether growing or stacked, vineyards, shrubbery, and even forest trees have been destroyed. As an example, Lenz thus describes a plague of mice in the years 1872–73:

> In the rich corn lands of lower Saxony, Thuringia, and Hesse they [mice] abounded to a fearful extent. Half the harvest was destroyed—hundreds of thousands of acres were left untilled—and thousands of pounds were spent on their destruction. Agricultural societies and Governments were implored to seek ways and means of staying the plague.

The extraordinary and rapid increase of a species until its numbers assume the proportions of a plague is rare among mammals. Such increase is most frequent among the several species of short-tailed field mice and the lemmings. These animals, indeed, through their great fecundity, are liable to break out periodically in vast numbers. When they have increased excessively, some species migrate in large bodies, travel long distances, and devastate the vegetation in their path. Other species, however, do not perform such marked migrations, but their excessive multiplication results in local and even more serious damage. Gregarious by nature, the vast bodies they form gradually extend from exhausted to fresh areas, until at length large districts have been overrun and laid waste.

A recent scourge in the United States lends more than usual interest to the subject, especially since the mice responsible are closely

related to the species which have caused such widespread destruction in the Old World.

THE NEVADA OUTBREAK.

In 1907–8 an outbreak of field mice in Nevada, Utah, and northeast California threatened to develop into a plague as great as any recorded. The greatest loss occurred in the rich fields of alfalfa bordering Humboldt River for the last 10 or 12 miles of its course to the Sink (Humboldt Lake, Nevada). Noticeable here through gradually increasing damage during 1906, the field mice appeared early in the summer of 1907 in alarming numbers. By November they had overrun a large part of the cultivated area, and on many large ranches were estimated by one of the assistants of the Biological Survey to number from 8,000 to 12,000 to the acre. Fields were literally honeycombed by their holes, which numbered about 24,000 to the acre. During the summer they ruined one-third of the alfalfa, destroyed three-fourths of the potatoes and badly damaged the remainder, and severely injured root crops, as beets and carrots. Upon the disappearance of green food in fall they attacked the roots of alfalfa and trees, causing far more serious damage. They ate so large a percentage of the plants as to render many alfalfa fields a total loss. They girdled and killed most of the young shade trees planted along ditches and about the borders of fields. Even such hardy trees as large Lombardy and silver poplars were killed, while small orchards suffered severely. (Pl. XXI.) By January, 1908, the ravages had extended over considerably more of the district, and the main body of mice was gradually progressing to fresh fields. From this time, however, the abatement of the plague was rapid. By March 15 the invasion of fresh lands had ceased, though mice continued considerably in excess of normal abundance until May. By August they had practically disappeared from the valley. This scourge left a dismal scene of destruction over four-fifths of the cultivated area in the district. Of 20,000 acres in alfalfa, 15,000 were so completely destroyed as to require replanting. (Pl. XXII.) Considering the actual losses in crops and the cost of restoring the alfalfa fields, and allowing for the value of the wheat which replaced alfalfa in most of the ruined fields for the season of 1908, a conservative estimate of the losses in this district is $250,000.

CONDITIONS FAVORING MOUSE PLAGUES IN THE UNITED STATES.

While the Nevada plague is the most serious recorded in the United States, frequent milder outbreaks in many parts of the country indicate that practically all our species of short-tailed field

mice periodically tend toward enormous multiplication. That this tendency is inherent can scarcely be doubted. Agricultural development, however, distinctly increases the danger of plagues by furthering the destruction of their natural enemies, by furnishing a great abundance of food, and by increasing the area in which they find favorable homes. The reclamation of arid lands affords most suitable conditions in large areas which were formerly uninhabitable. In these new lands, restricted by surrounding desert conditions, and stimulated by the rich food and dense shelter furnished by alfalfa, these mice are especially dangerous.

NATURE AND DURATION OF MOUSE PLAGUES.

Accounts of mouse plagues agree that the mice increase in numbers for a season or two preceding serious outbreaks, that the final production of hordes is comparatively sudden, and that the period during which mice swarm over the land is rarely longer than a year. The total duration of a plague may thus cover three or four years. Natural control invariably asserts itself by somewhat sudden and decisive destruction of the abnormal numbers. Usually plagues subside during the winter and spring following their maximum, disease and predaceous enemies being the most apparent causes. The subsidence of a plague is usually followed by a long period of depression. It takes the mice several years to regain normal abundance, and several years more before the danger of producing a plague again becomes imminent; hence in no locality have plagues been recorded oftener than once in eight or ten years. Field mice are very prolific, and in the absence of natural checks might produce a plague every four or five years. From two to six litters of young are produced annually. The average number of young at a birth is about 6, though frequently 8 to 10 are produced, and occasionally 12 or 13. Even the young born early in the season are said to breed before fall.

These mice are always present in or near the districts which they occasionally overrun, but ordinarily live in small colonies in favorable locations, particularly in damp areas bordering swamps, streams, or irrigation ditches. In alfalfa and other cultivated lands where the food supply is abnormally plentiful, and particularly if the natural enemies of mice are destroyed, the animals may increase greatly in one or two seasons, and the first breeding in the second or third season may produce great numbers. Then the mice spread over a greater area, and as the food at hand is consumed they may move on in troops. The final production of hordes requires but a few months—in fact, a plague may be well established by fall.

With the disappearance of green herbage in fall, reducing their food to roots and bark, mice move more rapidly from exhausted to fresh lands, and devastate larger areas. It is, then, through the progress of large bodies of mice, which may number thousands to the acre, that large districts are laid waste.

SUBSIDENCE OF PLAGUES.

After reaching a final autumnal climax and continuing through the winter in gradually lessening numbers, mouse plagues have usually abated early in the following spring, or at most have endured only through the ensuing summer. Like their development, the subsiding of such hosts is so gradual in the early stages as to be scarcely perceptible, though apparent enough a little later.

Most noticeable among the agencies which finally overcome them are predaceous birds and mammals. Attracted in large numbers to the feast, they live almost exclusively on mice during these periods, and, particularly in winter, make such severe inroads on the mice as to attract general attention. Still it is doubtful if, unassisted, they have ever overcome a plague. A conservative estimate places the number of predaceous birds which appeared in the stricken district in Humboldt Valley at 2,000; the predatory mammals at 1,000. It may be assumed that these 3,000 natural enemies would each destroy an average of 15 mice per day, or 450 per month, or collectively would kill 45,000 mice a day, or 1,350,000 per month. This number, vast as it is, is far too small to put an end to a well-established plague, although more than ample to check a plague during its early stages, or to completely wipe it out after the numbers have been materially reduced by poisons or other agencies.

In most of the accounts of mouse plagues the final destruction of the rodents has been ascribed to disease, and it is believed that the abatement of the plague in Humboldt Valley was aided by natural mortality. At intervals from January to March dead and dying mice were noticed in locations where poisoning could not have been the cause, but efforts to prove this mortality due to some specific bacterial disease failed.

In the spring the mice in this locality failed to reproduce, while the same species was breeding prolifically in other localities. In March several hundred females were examined in Humboldt Valley, of which very few were pregnant. Moreover, the mice themselves presented a different appearance from those seen when the plague was at its height—a fact noted by many ranchmen in the valley. During the fall of 1907 larger and much more vigorous individuals predominated, while in the spring of 1908 scarcely any of these remained. They continued in destructive numbers until the middle

LOMBARDY POPLAR GIRDLED ABOUT THE BASE BY FIELD MICE. MOUSE HOLES UNDER THE TREES.

FIG. 1.—ALFALFA FIELD DESTROYED BY FIELD MICE. GENERAL CONDITION OF FIELDS IN HUMBOLDT VALLEY, NEVADA, IN NOVEMBER, 1907.

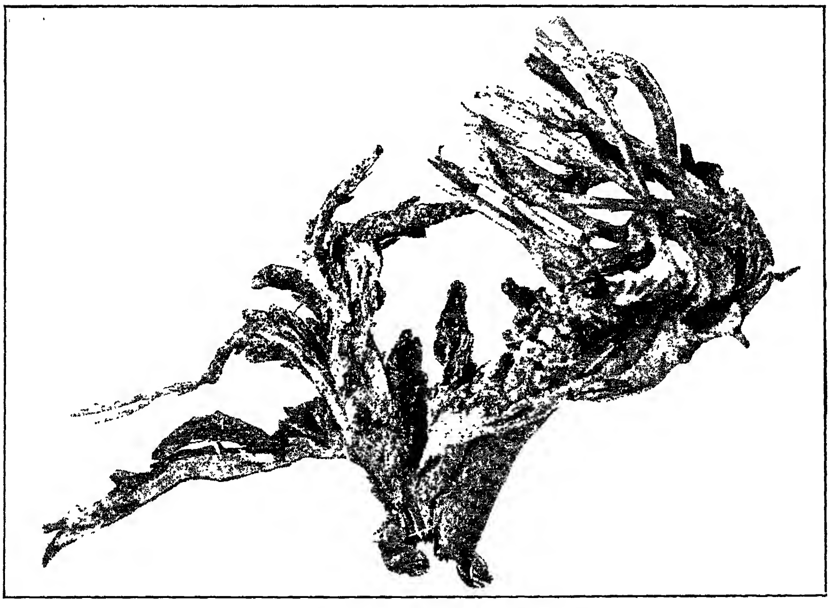

FIG. 2.—HOW ALFALFA PLANTS WERE DESTROYED.

THE CARSON MEADOW MOUSE (MICROTUS MONTANUS).

of March, 1908, and in more than usual abundance until May, and in some few centers even later. But they did not noticeably breed with the return of favorable weather, and by August had practically disappeared.

THE PLAGUE MOUSE.

The mice which produce plagues almost invariably belong to the genus *Microtus*, a group represented in the United States by about 50 species. Variously known in European countries as voles, wühlmäuse, and campagnols, and in the United States as short-tailed field mice or meadow mice, their general characteristics are everywhere the same. Except in the deserts, one or more species are present in practically all parts of the country, and normally they are among the most abundant of mammals. The annual damage they cause to crops, nurseries, and orchards in the United States has been estimated at over $3,000,000.

With few exceptions, the short-tailed field mice are readily distinguishable from other mice by their stout, chunky bodies, short legs, short, round tails, blunt muzzles, short ears, and rather small eyes. Most of them are dark brownish or grayish brown in color and considerably larger and heavier than the common house mouse. (Pl. XXIII.)

They live almost everywhere in damp meadows, where their presence may be detected among the grass and weeds by small, well-defined, crooked trails, along which at intervals are little heaps of fresh grass or other herbage. In alfalfa or clover fields their numerous small burrows are usually in colonies. As a rule they appear first along ditches or about damp areas, where dead plants are almost certain evidence of their work.

CONTROL OF MOUSE PLAGUES.

In the past many methods of destroying field mice have been tried, yet the records describe no instance in which well-established plagues have been successfully suppressed. Failing to recognize the early stage of the plague, the people in stricken districts have usually not adopted vigorous measures until after the fields were swarming with mice. The failure, then, has been due partly to lack of cooperation and partly to lack of knowledge of quick, cheap, and effective measures. Without witnessing such a plague one can hardly form a conception of the almost incredible numbers of mice and of the magnitude of the task of destroying them.

Among methods of little value which have been tried in other countries to rid the land of these scourges are rolling the land with

heavy cylinders; trampling it by cavalry or by droves of sheep; liberating large numbers of cats; and injecting water, steam, or suffocating gases into the mouse burrows. Many measures practicable on a small scale or of value in the early stages are entirely inadequate for the suppression of well-established plagues, particularly where farms are as large as in the United States. Among such methods are digging trenches or pitfalls wider at the bottom than at the top, into which the mice fall; killing by means of traps, clubs, or dogs; burning off the herbage in infested areas; and flooding the fields. The elimination of these leaves as methods generally applicable for suppressing plagues only two—the employment of disease and poisoning.

DISEASE.

The employment of bacterial diseases fatal to rodents has been a subject of considerable research and experimentation. It is evident that a disease which will quickly spread from one mouse to another, without endangering other animals, is exceedingly desirable. While epidemics of disease have been frequently considered a prime cause of the abatement of plagues, it has not yet been demonstrated that such epidemics can be artificially produced. Dr. Loeffler's experiments in destroying field mice in Thessaly in 1892-93 by means of the *Bacillus typhimurium* were reported as completely successful, but now it appears questionable whether these results did more than synchronize with the natural abatement of the plague. Experiments in Russia in 1894 with the similar organism isolated by Mereschkovski were also reported as successful; and in France, in 1904, the Danysz virus is said to have proved in a measure efficacious.

Attempts by ranchmen to produce epidemic disease among the mice in Humboldt Valley by means of advertised bacterial preparations failed. Although we admit that, when properly distributed and fresh, these organisms are fatal to those mice which eat them, yet on this basis they are still far too expensive for general employment.

POISONING.

Poisoning is the most generally applicable, cheapest, and most certain means for controlling mouse plagues at present known. Poison preparations, however, must possess, in addition to effectiveness, the least possible danger to man, to domestic stock, and to valuable wild birds and mammals. The following recommendations are based on extensive experiments and practice during the mouse plague in Nevada, and are applicable to similar species of mice elsewhere. Phosphorus, on account of its extremely dangerous character, the limited number of baits on which it can be used, and its destructive-

ness to birds and mammals, is out of the question. Among less virulent mineral poisons, arsenic, barium carbonate, lead acetate, and mercuric chlorid give no results warranting their recommendation; moreover, when used on a large scale, they prove quite as expensive as strychnine.

All things considered, strychnia sulphate is by far the best poison to employ. Properly used, this drug at 75 cents to $1 an ounce is cheaper for the purpose than arsenic at 15 cents a pound. Used on grain it is considerably more expensive than phosphorus, but it can be used on other mediums which make it the cheapest poison available. Tests with a variety of materials show that three possess great advantages as vehicles for poison. These are alfalfa hay, green alfalfa, and crushed wheat. They should be prepared as follows:

Poisoned alfalfa hay.—Chop 30 pounds of good, fresh alfalfa hay into about 2-inch lengths with a feed cutter. Then place the hay in a large metal receptacle and sprinkle with 3 gallons of fresh water. Thoroughly dissolve 1 ounce of strychnia sulphate in 2 gallons of water by heating in a closed vessel; sprinkle over the dampened hay and mix well. (Pl. XXIV, fig. 1.)

Poisoned green alfalfa.—Heat 1 ounce of strychnia sulphate in half a gallon of water until thoroughly dissolved, add to 1 gallon of cold water, and sprinkle this solution slowly over 45 pounds of fresh green alfalfa, cut into lengths of 2 or 3 inches. Mix until the free solution is taken up.

Poisoned crushed wheat.—Dissolve 1 ounce of strychnia sulphate in 2 gallons of water by heating. Sprinkle the solution over 60 pounds of rolled or crushed wheat in a metal receptacle and mix well. If the preparation is to be kept for several days, 2 tablespoonfuls of powdered borax may be added to prevent fermentation.

Poisoned alfalfa hay proved the best during winter, when green food was absent, and was recommended generally in Humboldt Valley. From January 15 to March 15 it was used extensively in destroying the mice in the area in which they were most abundant, and its use was not attended by a single accident to birds or to animals. From 7 to 15 men were employed on a single ranch in distributing it, placing a small pinch, equal to about a teaspoonful, at the mouth of each burrow, or in cold, rough weather dropping it into the underground runs. In fields where mouse holes numbered 10,000 to 24,000 to the acre, there were 10 or more burrows for each mouse, and in fields partially deserted the proportion of unoccupied holes was much greater. Dragging the fields with a brush drag (Pl. XXV) to obliterate the holes proved important, for within twenty-four hours the occupied holes were reopened, and poisoning

could be done with a saving of nearly 50 per cent in labor and materials. A single treatment of the land with poisoned alfalfa hay destroyed 85 to 95 per cent of the mice at a cost, including labor, of about 35 cents an acre. Had this method been employed earlier, it is certain that the plague could have been broken and a great part of the ravages averted.

In April, 1908, mice had become so alarmingly abundant in parts of Carson Valley, Nevada, that an urgent appeal for assistance was sent to the Biological Survey. On visiting the valley it was found that in an area of about 2,000 acres near Minden the mice numbered 500 to 1,000 to each acre and had already destroyed 10 to 25 per cent of the alfalfa, and that by reason of rapid reproduction they gave every indication of producing a plague similar to that which had stricken Humboldt Valley. Preliminary tests of a number of poisoned baits were at once carried out. Poisoned green alfalfa placed in the trails and in the burrows of the mice proved fatal to practically all the mice in the areas treated—not a remarkable result, as these mice habitually cut green alfalfa, stack it along their runs, and later carry it into their holes. Poisoned crushed wheat proved distinctly better than the whole grain, killing a larger number of the mice, particularly of the small young.

The importance of treating quickly the infested area prevented the extensive use of green alfalfa, since this material must be distributed during evening hours to prevent drying by the sun, while crushed wheat may be distributed all day long. Poisoning with crushed wheat resulted in the destruction of fully 85 per cent of the mice, at an average cost, including labor, of about 40 cents an acre. Unfortunately a large number of magpies and blackbirds fell victims to the poisoned grain; while to a less extent meadowlarks, killdees, and mourning doves were killed. Under conditions threatening a plague the destruction of the mice is of prime importance, but care in putting out the smallest amount of poison needed to destroy the mice will greatly lessen the danger to birds. A teaspoonful of properly poisoned grain is sufficient to treat three or four mouse holes.

Poisoned green alfalfa should be used where it is possible in preference to crushed wheat, since it is even more effective and eliminates all danger to birds. It is particularly recommended for small areas or where mice are not extremely abundant. Irrigation drives the mice temporarily to the elevated ditch embankments and to the borders of fields, thus presenting an opportunity to use this material with great effect.

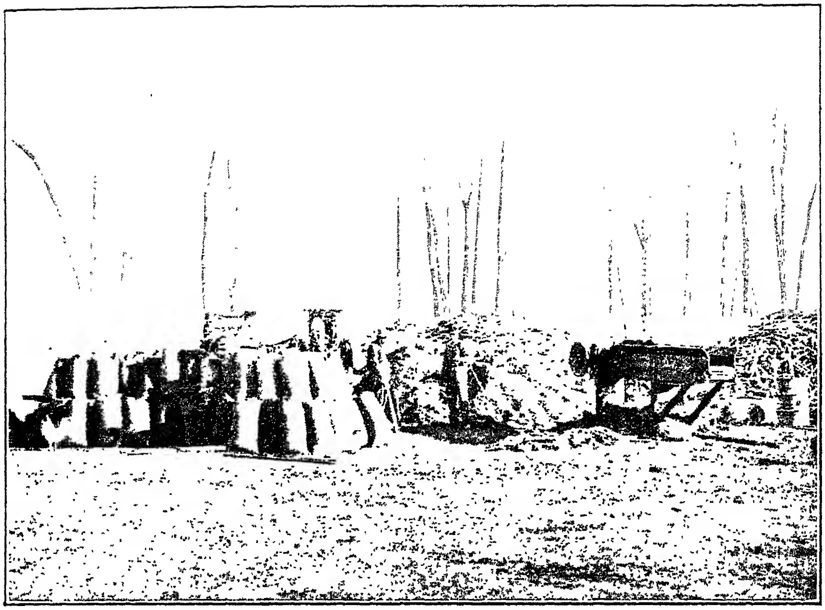

FIG. 1.—PREPARATION AND SACKING OF ALFALFA HAY, INDICATING THE EXTENT TO WHICH IT WAS USED IN POISONING OPERATIONS IN HUMBOLDT VALLEY, NEVADA

FIG. 2.—GULLS DESTROYING FIELD MICE IN THE ALFALFA FIELDS OF HUMBOLDT VALLEY.

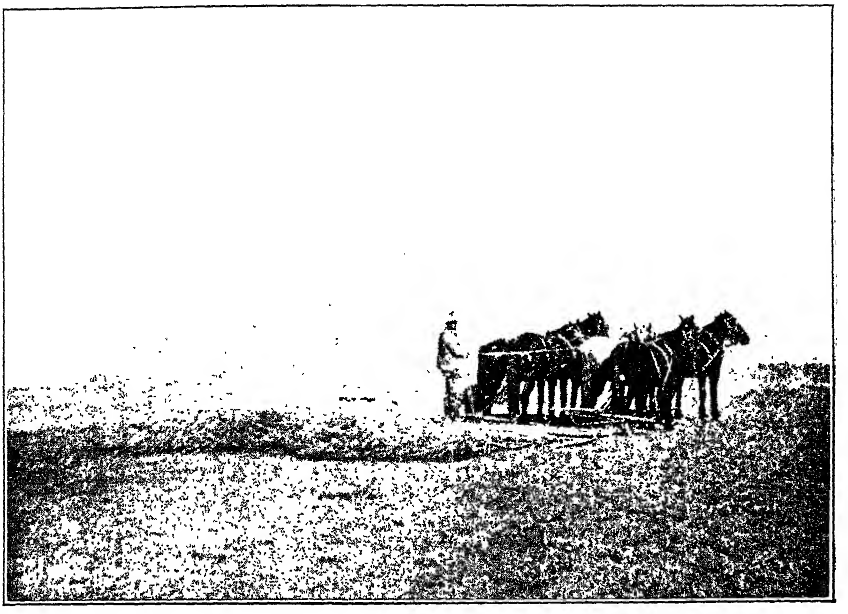

FIG. 1.—BRUSH DRAG USED TO OBLITERATE MOUSE BURROWS.

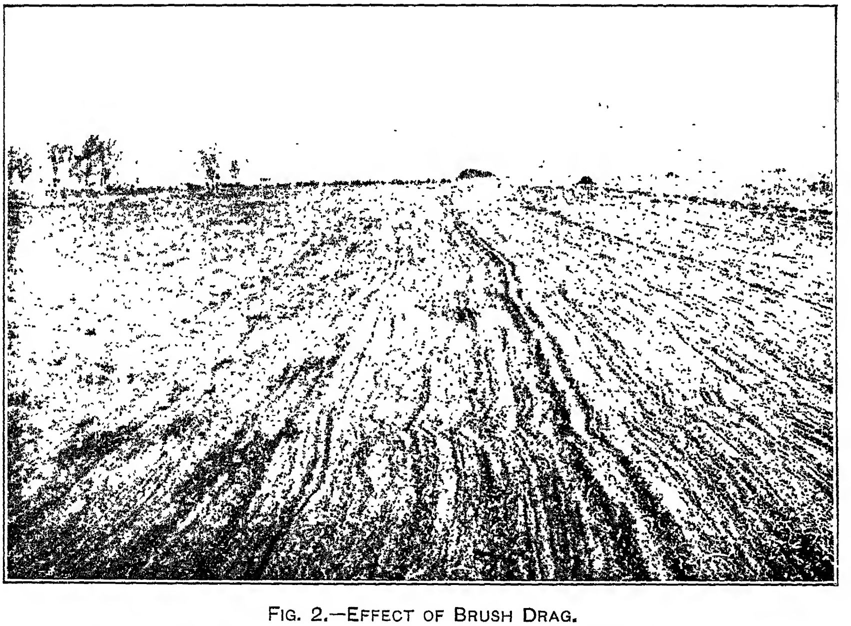

FIG. 2.—EFFECT OF BRUSH DRAG.

PREVENTION OF PLAGUES.

The prevention of plagues is comparatively easy. Their gradual development affords opportunities to suppress them, even after the damage has become quite extensive. The destruction of the mice whenever they become at all numerous not only prevents considerable damage, but is the best safeguard against serious outbreaks. Systematic poisoning must be relied upon to repress them when they are obviously on the increase, but there are many inexpensive methods for preventing this increase. The destruction of rank grasses and weeds along fences and ditches, and particularly the pasturing off of the last growth of alfalfa in fall, thus exposing the mice to the attack of predaceous enemies, are important. Winter burning the dry vegetation on wild hay lands, on strips bordering fields, and on swampy or otherwise waste areas in and about cultivated fields will aid materially in controlling them. The survivors may invade cultivated fields, but there they can be more readily poisoned. Flooding the fields in cold winter weather, when the mice quickly perish from exposure, is an effective method in irrigated lands. Plows turn out the burrows and nests of practically all the mice present and render them easy victims for dogs, which when trained to kill mice can not be too highly recommended as effective and inexpensive aids in controlling the pests.

Among the agencies which check the increase of field mice none are more important than their predaceous enemies. These mice, the favorite food of many birds and mammals, active night and day, summer and winter, are preyed upon more than any other mammal. That hawks, owls, gulls, crows, ravens, and herons among birds and skunks, weasels, foxes, and badgers among mammals are persistent enemies of field mice and other rodent pests has been often pointed out. The protection and encouragement of these valuable allies of the farmer can not be too strongly advocated. (Pl. XXIV, fig. 2.)

CONCLUSION.

Mouse plagues are usually preceded for a season or more by noticeable damage to crops, and success in checking them depends upon prompt recognition of the early stages of outbreaks. When mice first attract attention by increased numbers and by damage here and there, it is high time to destroy them.

The work carried on by the Biological Survey in Nevada, especially in Carson Valley, demonstrated that plagues can be controlled. The systematic poisoning of 10,000 acres in Humboldt Valley during the fall months, at a cost of about $4,000, would have prevented the larger part of the damage, and it is safe to say would have saved at least $175,000 worth of alfalfa.

But prevention of mouse plagues is far better and easier than their control after they have gained full headway. Field mice, wherever they abound, should be regarded as a menace, and their natural enemies should be protected and encouraged. In ordinary times mice should be killed by dogs, by flooding fields in cold weather, by winter poisoning, and by burning herbage which affords them shelter. Holding field mice in check is worth its cost many times over in minimizing the steady drain they inflict on farm products; moreover, it is the best preventive of widespread devastation.

CAUSES OF SOUTHERN RURAL CONDITIONS AND THE SMALL FARM AS AN IMPORTANT REMEDY.

By S. A. Knapp,

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NATURAL ADVANTAGES OF SOUTH ATLANTIC AND SOUTH CENTRAL STATES.

If delightful climate, fertile soils, satisfactory rainfall, a large number of navigable rivers, an abundant supply of valuable timber for construction purposes, an inexhaustible wealth of minerals, and a marvelous topography—wonderful valleys, fertile hills, and picturesque mountains—are essential factors in the making of a mighty nation, then the South Atlantic and the South Central States of our Union were designed by nature to be the seat of great activities along broad lines, with a dense population rich in all material things—the masses well housed, broadly educated, independent, and progressive. No equal area upon the globe surpasses these States in the natural resources enumerated.

ECONOMIC ERRORS OF THE OLD SOUTH.

These States were settled mainly by one of the most virile races that ever touched foot on western shores. Why, then, did many of the results which appeared certain to follow fail to materialize? It was because of some economic errors that crept into the civilization of the South at an early period, and shows the far-reaching effect of even slight deviations from the fundamental laws that govern civilization.

(1) The labor was mainly compulsory and performed by another race. This lowered the dignity of labor, because unavoidably the character of the doer determines the dignity of the thing done. It ought not to be thus, but it is and has been the case from the formation of human society. This condition was a barrier to free labor and an obstacle to the immigration of small farmers accustomed to till their own lands. These influences in many cases contributed to an emigration of these classes from the South.

(2) The second great economic error was the adoption by the Southern States of the one-crop system of farming. True, they chose their staples with wisdom—tobacco, rice, sugar, and cotton—four of the best staples—and they found world markets for them. Upon the surface it appears just as sound a policy for a farmer to produce one cash crop and supply all his wants from the sale of it as it is for a manufacturer to limit his output to one article instead of many. There is, however, this difference: The manufacturer is sure of his product, at uniform cost and of standard quality; the farmer is never certain of the quantity, quality, or cost of his crop, and should throw out an anchor of safety, so that whatever may occur to reduce the cash crop it will not curtail the supply of food or clothing, interfere with the schooling of the family, or place in jeopardy the home.

The great objections to the single-crop system are that it limits knowledge, narrows citizenship, and does not foster home building, but does promote commercial farming. It lacks the element of safety; if the one cash crop fails, everything goes—living, clothing, and all. It might be asked why the many small farmers of the South did not diversify their crops. Farmers can not produce any cash crop they like. It must be something recognized by the local market, and the large planters make the local market.

(3) A third economic error from the standpoint of the state was the great number of large plantations in the South. A plantation of several thousand acres worked under one management is like a great factory; each person employed is limited to one kind of labor. He may work in the stables or garden, be a field hand, or be assigned to making general improvements and repairs. In any event, there is one line of work he follows for life, and he knows no other. That may be satisfactory from the machine standpoint, but it is bad for the citizen. The large plantation, as generally managed, blocks highways, interferes with schools, retards rural development, and promotes class distinctions as against mass development.

(4) A fourth economic error was failure to utilize the wealth of minerals, the vast forests of woods matchless for construction purposes, and other natural resources of the South in such a way as to build a commonwealth that would furnish markets as well as raw material and thus in a measure become self-sustaining and independent.

The neglect of common schools throughout the rural sections and the slight attention paid to internal improvements were the natural results of the other policies adopted.

The price of virgin lands averaged so low that in many cases it was cheaper to make a new plantation than to restore the impoverished soils of the old.

The foregoing statements present only the general view. There were under the old conditions many planters of high character and great intelligence who maintained an excellent standard of agriculture. They bred the best stock of the world and followed an excellent system of crop rotation.

DISASTROUS TRANSITION PERIOD.

The period of greatest disaster to agriculture in the South was from 1861 to 1890, when nearly all that was excellent in the old civilization was swept away and little of value substituted. During this period the South was laid waste by the barbarism of war; then an unlettered and previously subordinate race, in some States more than equal in numbers to the rural white population and but slightly amenable to its public opinion, received the ballot and came into the possession of lands as owners, renters, or occupiers. A lowering of country life drives out the better classes just as an inferior coinage usurps the place of the more valuable. That the lands were first held by a great and virile race is shown by the fact that Caucasian civilization was not completely overwhelmed by such masses of another race and condition. Nonresident ownership increased, and with it came a more careless tillage, immense waste of fertility by erosion, and a general deterioration in the character of farm improvements and equipment. Until within the last decade and a half rural conditions and general influence upon National life steadily declined.

ADDITIONAL CAUSES OF DECLINE.

Two other causes of universal effect have operated with tremendous force in the depression of rural conditions in the South: One is transportation and the other is money—both vital to farm values and farm profits. The cost of transportation of products from the farm to the seaports has been too high. The poor highways have been one factor contributing to this; the single commercial crop system has been another, because it supplied freights only a few months in the year, furnishing an oversupply for such periods and a deficiency for the remainder of the year. The one cash crop intensified the want of money. It took most of the annual proceeds of the crop to buy needed supplies, and it created an abnormal demand for money to move out the main crop when it matured.

Another serious obstacle to rural progress has been a scarcity of labor. The employers of labor in factories and in the construction of railroads have been able to pay much higher wages than farmers could afford and have drawn not only the hired laborers from the farms but many small independent owners of land from their homes.

RECENT AWAKENING AND BETTER PRICES.

Notwithstanding these adverse conditions there has been a great improvement in the South in the last twelve years, due in part to the general prosperity of the country and in part to the heroic efforts of her people. They have put forth almost superhuman efforts to reconstruct upon the best basis what was left, to rebuild what of value had been destroyed, and to create whatever was necessary to round out the best civilization of the age. No people ever worked more heroically and with greater unity of purpose.

The higher price of cotton, sugar, and rice, three of the great cash crops of the South, has, for the first time since disaster came, provided the means to get out of debt and improve conditions. With the improvement of fortunes prompt attention was given to home building, the encouragement of education in the founding of schools, the establishment of manufactures, and a comprehensive system of internal improvements. The South is rural, and her most significant sign of awakened interest is her effort to place agriculture upon a better basis.

SMALL FARMS ESSENTIAL TO PERMANENT PROSPERITY.

One object of this paper is to urge that in this great uplift which marks the people of the South as patriots there shall not be omitted from the solid foundation placed under their new civilization some of the essential supports that uphold and perpetuate a republic.

In the great cities and in the manufacturing centers there has been for centuries and probably will continue to be an unrest that arises from a conflict between aggregated capital and organized labor. The great counterbalancing force is a body of prosperous and contented small farmers distributed over the entire country.

A prosperous, intelligent, and contented rural population is therefore essential to our National perpetuity. The world's experience has shown that the best way to secure this is to encourage the division of all the lands into small farms each owned and operated by one family.

There are two ways to look at a small farm: One view—the common one—is that it is a place to make a living, but rather a hard place, and should be sold as soon as anything easier is found; the other is that the owership of land is a mark of honor, that a patent to land is a title to nobility, a right to sovereignty. The ownership must be absolute and subject only to the state, so that each proprietor is the independent sovereign of a portion of the United States, with the final authority through the ballot to control the local, county, and National governments—a position of great dignity and power.

We speak of "the sovereign people." Are they to be sovereign in fact or only in theory? If in fact, then each citizen must own and control something. In a sense he must be lord of a certain territory. This territory is called a farm, but legally it is a subdivision of the state, to which the farmer receives perpetual title in order that he may have the means to support his position as an independent sovereign with dignity and by absolutely governing a small portion of the United States learn to assist wisely in governing the whole.

BEST SIZE FOR SMALL FARMS.

This is the attitude of the state toward individual ownership of land, and these lands should be of an area that will come nearest to the development of the perfect citizen and ruler. The area must not be so large that the income will support the owner without effort on his part, nor should it be so small that it will make a mere toiler out of the owner, for this narrows the intellect. It should be large enough to provide good farm equipment, buildings, machinery, and stock and furnish labor for the family. The annual income must be sufficient to improve the farm, educate the family, assist in starting its members in ways of independent support, and provide a reserve for old age. The United States has fixed that area in some States at 160 acres. The right acreage of the farm depends upon conditions. In semiarid sections it may require more than double that number of acres, while near large cities less than one-fourth may answer the purpose.

CHANGES NEEDED TO INCREASE THE DIGNITY OF RURAL LIFE.

Under the new order of things, to attain the best results, the policy of maintaining large plantations in the South must be abandoned; all the idle lands must be brought into use and made profitable; labor for men and women must be held in honor; diversified agriculture must supplant the one-crop system to insure safety, and all the best conditions for a life of usefulness, culture, and influence must be established in the country.

Before rural life can be held in the highest honor the following conditions must be secured:

(1) A much larger percentage of the farmers and their families must be broadly educated and of high character.

(2) The farm lands must be so improved and managed as to yield a more certain and profitable return for labor expended and afford greater profit than employment in the city.

(3) The farm improvements must be durable, suited to the requirements of the farm, convenient, and attractive.

(4) Churches, schools, means of communication, social conditions, and opportunities for accumulating wealth and for civic preferment must be better for the masses in the country than in the city.

AGRICULTURAL COLLEGE TRAINING ALONE NOT SUFFICIENT.

The problem is how to effect these rural changes for the better. Education being so important, many have thought and still think that the establishment of agricultural colleges will accomplish the object. Forty years' trial has shown that most of the college-trained youth, whether in schools of agriculture, science, or classics, leave the farm for reasons not difficult to understand. The education required is one that can reach the adult masses as well as the young and will hold them to the farm. The error is in a failure to see that the situation can not be overcome by a college education, however helpful it may be to a man as a citizen. It is a mass problem and must be met by a mass training.

THE SMALL FARM THE BEST SCHOOL.

The practical and sane way of accomplishing the result is to induce the farmers to try better methods and note the result in improving their farms—to make tillage less expensive and production more certain, to double the crop to the acre and halve the cost. While the farmer successfully solves the problems of the farm his experience widens and he becomes a broader man, till he is broad enough to size up the whole situation and has the means to execute his plan. As men broaden they have higher aspirations for their children, and better scholastic education will accompany the general uplift.

Well-informed men who are successful farmers are generally agreed that a thorough knowledge of agriculture can be acquired in one way only, and that is by working out the problems of the farm upon the farm. There is a world of details, of business knowledge, skill, and tact about farming that can be acquired only by contact with the soil and experience in the life of a farmer.

This education of the farmer upon his farm by working out problems in the field and receiving the answer in the crib or granary is, like all education, a personal matter, and each man must acquire it for himself. This points to the small farm, personally worked, as best for the man, for the land, for society, and for the state.

Education is what a human being absorbs in a usable form by experience, by observation, and from oral and written instruction. The world's most important school is the home and the small farm. To secure the best results the small farmer is forced to diversify his crop and to have a personal knowledge of all details relating to the farm. For safety he must get an income from a variety of products,

because a single crop may fail in yield or meet a nonresponsive market. This wider range of products broadens the knowledge of the farmer, and in the natural course of training he becomes skilled in the management of soils, cereal and grass crops, fruits, forests, domestic animals, farm machinery, and farm improvements. He is forced to be a student of markets and of the art of buying and selling to the best advantage; he learns the requirements of society and the advantages of cooperative effort. Cooperation may commence with an exchange of labor with a neighbor because he is short-handed, and it may be extended until there is cooperation with several in buying and selling, in promoting better highways, schools, and churches, and in the general uplift of the neighborhood.

This small farmer acquires his knowledge from many viewpoints—as a laborer and an employer; as a wage-earner and a capitalist; as a producer and a consumer; as an owner of land and a payer of taxes; and as a recipient of the benefits that come from rural improvement and the maintenance of law and order. No school or college in the land affords such varied instruction as this farm life or impresses it so lastingly upon the mind.

It is a school in which common sense is taught. Common sense is a thorough appreciation of common things and how to use them to the best advantage, or, if principles, how to apply them. This sort of wisdom can only come through experience. Many persons with slight acquaintance with books are perfect encyclopedias of the common and exact knowledge so useful in everyday life.

THRIFT AND CONSERVATISM CHARACTERISTIC OF THE SMALL FARMER.

No nation can be great without thrift. Thrift is the conservation of the products of toil and is taught by lessons of privation. Opulence and large incomes are not teachers of thrift. Even such as receive a fixed salary or the wage-workers learn less of thrift than the small farmer. Once the harvest is ended, the products must be stored with care to meet the wants of the family, and all the more care is necessary if there is no credit system.

The small farmer becomes conservative. He is not sure of the harvest or of the markets, and when these are made sure he has learned that the problems of another season must be met before the present income is safe from depletion.

Communities of small farmers tend to promote common honesty, a respect for the rights of others and for law. No one is rich enough to dominate his neighbors or so poor that his influence may be disregarded. The stock, products, and property of all are alike exposed to trespassers and depredators; hence, a common interest unites them for mutual protection, and the primary lessons of society are thus taught.

The education acquired on the small farm broadens citizenship, because it is a many-sided education and gives correct impressions of many phases of life. All over the world the small, independent farmers are staunch supporters of conservative government. They are intense lovers of home and opposed to radical changes.

Ultimately the small farmer learns to keep a reserve of cash against emergencies, and these aggregated accumulations become very important factors in the capital of the Nation, for they are more reliable than deposits from commercial sources. The vast sums of money necessary to carry on the business of a nation are not derived from the deposits of capitalists, but from the aggregation of millions of thrifty small depositors. This is especially true in England, France, Germany, and the United States.

It has been observed for years that the sons of small farmers develop managing ability. From their earliest years they are compelled to do things and to act independently. It is from this source that the greatest number of managers of the various enterprises of our country have been drawn.

A BODY OF SMALL FARMERS ADVANTAGEOUS TO THE NATION.

If all is considered education that "leads out," develops, or trains the individual, then the amount of education acquired in even the best schools is only a fraction of what the average man must know to succeed in life. It is, then, of the highest importance to the state that this greater mass of knowledge should be correct, broad, conservative, and elevating. Liberal provision has been made for schools by the state, by churches, and by individual gifts, but the molding of this greater knowledge to the best interests of society has been mainly left to the caprice of individual effort. The state can with propriety specially foster such conditions of society, such lines of industry, or such occupations as evidently tend to mental and physical vigor, to breadth of understanding, to the best citizenship, and to the stability of the state. For these ends no more potent influence has been found than an intelligent, prosperous, and contented body of thrifty small farmers.

POSSIBLE STEPS TOWARD THE FOSTERING OF SMALL FARMERS.

The States and the National Government have aided by the gift of lands for homes and by the promotion of rural schools and free mail delivery. What further steps can the Government rightfully take to improve rural conditions? Inasmuch as the net values of all the products ot the farms depend upon the cost of transportation as well as the markets, the National Government should see that rural districts are served at a freight charge based on the cost of service

performed, thus equitably distributing the burdens of transportation. From the fact that country roads are just as much a part of the transportation problem as railroads and waterways, the more important highways through the country should come under State and National supervision, and thus be made a part of our great system of improved transportation.

Some plan should be devised and framed into law by which the farmer may participate in the use of an equitable portion of the vast time deposits of the people's money at a moderate rate of interest and upon such securities as he possesses. This would open the door of opportunity for thousands of thrifty toilers to seek and establish rural homes.

By every means possible the great dignity of land ownership should be impressed upon the men and youth of the present generation; but mere reiteration, whether verbal or printed, will not accomplish the object. There must be real dignity; that is, the men on the farms must have character, manliness, education, and energy. The farms must show by their improvements and judicious management that they belong to that type of men, for the improvements are the visible expressions of what is in the man.

It is impossible to impress upon anyone that there is dignity in residing upon a farm with impoverished soil, dilapidated buildings, and an environment of ignorance.

The adult rural people of the South are open to conviction and eager to learn. The problem that confronts the States and the Nation is, Shall the opportunity be given to them or to their children?

Shall the better conditions be wrought out by successful demonstrations that influence the present toilers upon the farms, or shall the reforms be deferred until the next generation and accomplished by the education and training of the youth?

Why may not a prosperous people carry on both methods simultaneously and reach the desired end in the briefest period of time?

The great value of educating and training youth for agriculture is so universally conceded that it does not require discussion. The necessity of presenting and impressing better types of husbandry upon adult farmers through demonstrations under their care is rapidly being accepted by the American people as a most important means of education for the rural masses and necessary to any general and rapid advancement.

The opinion that the municipality, the State, and the Nation are responsible only for the mental training of youth, mainly through books, has been too common. A broader conception of education includes instruction to adults in all useful knowledge applicable to

their vocations. In agriculture, the knowledge of the best animals, implements, seeds, methods of culture, and farm management is a necessary part of the equipment of the farmer to do his best, and this knowledge must be made so intensive by demonstration that it will result in achievement. If the rural masses can be influenced to accept and adopt the best methods of tilling the soil, the best plants and fruits of their kind, animals of the greatest merit bred for the purposes intended, and a general farm policy and management that tends to the improvement of the soil, the most economic production, and the greatest thrift, a proper material basis will be laid for all other reforms and improvements leading to a broader National life. It is the intention in this statement to claim that this material improvement is a necessary factor in any permanent uplift and that the education of adults is essential to the great plan of human betterment.

RECENT WORK OF THE BUREAU OF ANIMAL INDUSTRY CONCERNING THE CAUSE AND PREVENTION OF HOG CHOLERA.

By M. Dorset,

Chief of Biochemic Division, Bureau of Animal Industry.

PREVIOUS WORK ON HOG CHOLERA.

As a result of researches carried out more than twenty years ago, Salmon and Smith reached the conclusion that hog cholera was caused by a small rod-shaped bacterium, named by them *Bacillus choleræ suis*. Salmon and Smith showed that this organism is present in the blood and organs of a great majority of the animals which die of hog cholera, and they showed also that by injecting pure cultures of this organism, or by feeding such cultures, they were able to produce, in many instances, lesions which were indistinguishable from those found in hogs which died from a natural attack of hog cholera. In addition they were able to recover this organism from the organs of all hogs which died from artificial infection with *B. choleræ suis*. These findings were confirmed by bacteriologists in this country and abroad, and as a result it has been generally believed that the etiology of hog cholera was settled, the cause being *B. choleræ suis*.

The cause of hog cholera being thus regarded as definitely established, most of the scientific work concerning this disease has, during the past twenty years, been directed toward the development of a vaccine or serum to be used for purposes of prevention. It is well known, however, that although some workers claimed to attain a certain measure of success, none of the methods proposed was found to act with sufficient reliability, when applied in a practical way in the field, to warrant its general use. Practically all of the methods proposed consisted in the preparation of vaccines or serums by using cultures of *B. choleræ suis*. The vaccines were prepared by attenuating this organism, or by extracting from it various substances which were used for the production of immunity. A number of authors also claimed to have secured good results by the use of serums, these serums being prepared by injecting or feeding animals with pure cultures of *B. choleræ suis* or with various substances derived from this organism. As has been stated previously, none of

these vaccines or serums gave satisfactory results in practice, and it may be said that for twenty years after the discovery of the supposed cause of hog cholera little or no progress was made in combating this disease.

The Bureau of Animal Industry has been unremitting in its efforts to secure some substance which could be used as a preventive or cure for hog cholera, but until three or four years ago little progress was made. Apparent success was attained in some instances, but at other times, and especially where the preventive was applied in the field, partial or complete failure was the result.

THE CAUSE OF HOG CHOLERA.

It is a fact known to all who have had occasion to study the disease that hog cholera is extremely contagious. Starting with the introduction of one sick animal into a healthy herd, the disease will spread rapidly from one to another until finally the great majority of the exposed hogs will contract the disease. It is also well known to practical hog raisers that a hog which has recovered from an attack of hog cholera is subsequently immune against that disease.

During the course of an experiment being carried out by the Bureau in which cultures of *B. choleræ suis* were injected into hogs for the purpose of producing immunity, it was noticed that in certain cases the injected animals would be made sick and would die from the injection. Associating with these hogs were others which were not injected and which were susceptible to hog cholera, but which did not contract disease from this association. At that time it was considered a very remarkable fact that the uninjected hogs associating with those made sick by cultures of the supposed cause of hog cholera did not in any case contract the disease. We also had occasion to note that, in certain instances where hogs recovered after being made sick through the administration of pure cultures of *B. choleræ suis* there was no evidence of an immunity having been acquired through the illness produced by the culture, for when exposed subsequently to the natural-disease hog cholera such animals, almost without exception, succumbed.

These results were considered to be of such importance that special experiments were carried out to determine beyond doubt whether or not the disease produced by *B. choleræ suis* is contagious, and also whether hogs which recover from an attack of illness produced by the administration of that organism are rendered immune against the natural-disease hog cholera. The results of these experiments completely confirmed the original observations and showed that in no case was the disease that was produced by cultures of *B. choleræ suis* transmitted to nonimmune hogs by association. It was also found

that an attack of illness produced by *B. choleræ suis* did not render the hog subsequently immune to the natural-disease hog cholera.

Salmon and Smith had previously observed that hog cholera is readily transmitted from one hog to another by injecting the blood of a sick animal subcutaneously into a nonimmune animal, and more recent experiments confirmed this. These later experiments showed also that the disease produced by the injection of hog-cholera blood, in marked contrast to that produced by the cultures, possessed the contagiousness of the natural-disease hog cholera and conferred complete immunity upon hogs which recovered. The only reasonable explanation of these differences in the characteristics of the disease produced by the blood on the one hand and by cultures of *B. choleræ suis* on the other seemed to lie in the supposition that some organism other than *B. choleræ suis* is concerned in the production of hog cholera and that this unknown organism is present in the blood of hogs sick of hog cholera. In order to settle this question, the most careful examinations were made of the blood of hogs sick of hog cholera, but neither by microscopic examination nor by cultural methods were we able to find any visible organism other than *B. choleræ suis* which could be regarded as playing any part in the disease.

Disease Due to a Filterable Virus.

It should be noted here that previous to this time certain highly contagious diseases, such as yellow fever, foot-and-mouth disease, and chicken pest, had been shown to be due to invisible viruses present in the blood or body fluids of diseased individuals. These viruses are invisible under the highest magnifications now available; they can not be cultivated artificially, and in addition when fluids containing these viruses are passed through porcelain or earthen filters the filtrates, though proven to be free from all known bacteria, are capable of giving rise to the disease in question in susceptible individuals. The conclusion reached by those who worked with such diseases was that they are caused by organisms of such minute size or of such structure that they may pass through the pores of porcelain or earthen filters. These organisms are spoken of as "filterable," "invisible," or "ultramicroscopic." From what has just been said it will be readily understood why, at this stage of the work of the Bureau concerning hog cholera, search was made for a filterable virus in the blood of hogs sick of hog cholera.

The results of this search, which has been described in bulletins of the Bureau of Animal Industry, showed that filtered blood serum from hogs sick of hog cholera, and proven to be free from all known bacteria, is capable of producing in hogs typical attacks of hog cholera, the disease produced in this way presenting the contagious-

ness, and the immunity upon subsequent exposure in the case of hogs which recover, which are characteristic of the natural disease, but which are lacking in disease artificially induced by cultures of *B. choleræ suis*. As a result of the experiments with *B. choleræ suis* and with filtered blood from hogs sick of the natural-disease hog cholera, the conclusion was reached that the filterable virus which is present in the blood serum of sick hogs is the prime cause of hog cholera. While it is recognized that *B. choleræ suis* is capable of producing many of the lesions seen in various cases of hog cholera, and that it no doubt frequently exercises considerable influence upon the outcome of an attack of the disease (that is, certain hogs sick of hog cholera might recover if not forced to combat the combined attack of *B. choleræ suis* and the filterable virus), for the reasons already given we regard *B. choleræ suis* as playing the part of a secondary invader solely.

The first announcement of the finding of this filterable virus was made in the year 1903, and an extended publication with a description of the experiments was issued in 1905. This work of the Bureau of Animal Industry and the conclusions reached have since been confirmed by investigators in various parts of the world, notably by Ostertag and associates in Berlin, by Hutyra in Austria, by the British Board of Agriculture and Fisheries in England, by Leclainche, Carré, and Vallée in France, and by Professor Uhlenhuth of the German Imperial Board of Health, after a most extended and convincing series of experiments.

THE PREVENTION OF HOG CHOLERA.

Having found that *B. choleræ suis* is not the true cause of hog cholera, the failure of earlier attempts to produce a satisfactory vaccine or serum for that disease could be readily understood, for although we might protect hogs from the attacks of *B. choleræ suis* by means of vaccines or serums derived directly or indirectly from that organism, we could not expect to secure protection from the filterable or ultramicroscopic virus by such means.

The filterable virus which exists in the blood of hogs sick of hog cholera has never been grown artificially. For this reason it is evident that any agent which is to be a true vaccine or preventive for hog cholera must be prepared directly or indirectly from the blood or body fluids of hogs sick of hog cholera which contain this virus. Following up this idea, many attempts were made to produce a vaccine by attenuating the virus in the blood. This attenuation was attempted by means of drying, by means of heat carefully regulated, and by the use of various chemical agents. In no case were we able to procure a vaccine by such methods which could be depended upon. At times ex-

cellent results were obtained, but at others the vaccine was found to be either too weak, therefore affording no protection to susceptible animals, or too strong, thereby causing serious injury or death of the vaccinated animals.

Immunity Secured by the Use of Blood Serum.

At the same time that these attempts at attenuation were being carried out efforts were made to produce a protective serum by injecting animals with the blood from hogs sick of hog cholera. For this purpose donkeys and immune hogs were employed. The serum from donkeys did not prove to be effective, but that obtained from immune hogs was found to possess remarkable immunizing properties.

It is not necessary at this time to discuss these earlier experiments, as the records of this work have been published elsewhere,[a] and as the original methods of producing the serum have been modified in many respects. Some of the details of the process as it is now carried out may, however, prove to be of interest.

In the first place, it should be stated that the underlying principle in this process consists in increasing the protective substances in the blood of immune hogs by treating these immunes with the virus of hog cholera. Any hog that has recovered from an attack of hog cholera or that has passed through an outbreak, associating with sick hogs without contracting the disease, may be regarded as an immune. The virus of the disease is readily available in the blood of hogs sick of hog cholera. Aside from the details of the treatment to which the immune is subjected there is one point that is of vital importance: The hog-cholera blood which is given the immune for the purpose of raising the protective power of its blood serum must be of a high degree of virulence. The object sought by the injection of the immune with the virus is of course the stimulation of the defensive mechanism of the hog's body to such a degree that protective substances will be formed in excess and float free in the blood of the immune. These protective substances are then secured for use in protecting susceptible hogs by drawing blood from the immune. If the immune hog does not receive blood of high virulence the reaction following this injection will be comparatively slight, and the amount of protective substances produced by the immune will be correspondingly small. This would result in a serum that might be so low in potency as to be unsuitable for practical use.

To ascertain the virulence of blood from any given outbreak of hog cholera two nonimmune hogs may be injected with small amounts (2 c. c. to 5 c. c.) of the blood. If these do not sicken promptly

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[a] Bulletin 102, Bureau of Animal Industry, U. S. Department of Agriculture, 1907.

and exhibit acute symptoms of the disease the blood is not suitable for injecting the immune. Having secured an immune hog and disease-producing blood of proper virulence, the protective serum may be produced in almost any amount after the first lot is secured, for each of the vaccinated hogs becomes an immune which is available for serum production, and the disease-producing blood can be kept available by transferring the disease regularly from the original hogs injected with it to other susceptible hogs.

The methods now in use for hyperimmunizing[a] the immunes, for drawing blood from immunes, and for vaccinating susceptible hogs are given below in some detail, though many points which are of much practical importance in producing the serum can not be touched upon in this paper.

The Process of Hyperimmunization.

The disease-producing blood may be injected into the immune in a number of different ways and in varying doses, as follows:

1. *Subcutaneous injections:*

    (*a*) Inject the immune subcutaneously with defibrinated disease-producing blood in the proportion of 10 c. c. of blood for each pound of body weight; or

    (*b*) Inject the immune subcutaneously with 1 c. c. of defibrinated disease-producing blood for each pound of body weight. After an interval of one week give a second injection of 2.5 c. c. disease-producing blood for each pound of body weight. After another interval of a week give a third injection of 5 c. c. of disease-producing blood for each pound of body weight.

2. *Intravenous injections:*

    (*a*) Inject the immune intravenously with defibrinated disease-producing blood in the proportion of 5 c. c. of blood for each pound of body weight; or

    (*b*) Inject the immune intravenously with defibrinated disease-producing blood in the proportion of 5 c. c. of blood for each pound of body weight, and after an interval of a week, if the hog has recovered, repeat the injection.

3. *Intra-abdominal injections:*

    Inject the immune intra-abdominally with defibrinated disease-producing blood in the proportion of 10 c. c. of blood for each pound of body weight.

It will be understood, of course, that the above directions for treating the immune hog are not inflexible, for satisfactory results could, no doubt, be secured by modifying the method of administration, the number of doses given, and to a slight extent, perhaps, the

[a] The term "hyperimmunize" is used to designate the process of increasing the immunity of the already immune hog by the injection of disease-producing blood.

amount of disease-producing blood employed, though from our own experience there appears to be little to be gained by materially increasing or diminishing the amounts of disease-producing blood, experience having shown that larger amounts can not be conveniently injected and that smaller amounts produce a serum of lower potency than that secured by the injection of the amounts given above. Immune hogs are not greatly affected by these injections, the most noticeable symptoms being loss of appetite and listlessness for a few days after injection, and following the subcutaneous injections there may be soreness and stiffness for a few days. When properly carried out any one of the above plans for treating the immune will produce a serum that will protect hogs from hog cholera.

Drawing Blood from the Immune.

As has been stated, the serum which is used for protecting non-immune pigs is secured from the immune after this animal has been injected with the disease-producing blood and has recovered from the effects of this injection. In almost all cases the immune will have recovered and will be in condition for bleeding within a week or ten days after receiving the disease-producing blood. Immunes "hyper-immunized" by one large subcutaneous injection usually regain their health more slowly than hogs treated by other methods.

Blood may be drawn from the immune by severing the carotid artery, thus bleeding the hog to death, or by cutting off the tail. The latter method is always to be preferred for the first drawings, as the bleeding may be stopped at any time, thus permitting the immune to live and furnish more blood later on. A large number of experiments have shown that, after hyperimmunization, blood may be drawn from the tail of the immune three or four successive times, at intervals of a week between bleedings, without any perceptible effect upon the protective properties of the serum which is secured. By repeating the bleedings in this way much more serum is secured than by one bleeding from the carotid artery. As a routine procedure, very satisfactory results have been obtained by bleeding the immune three times from the tail, and then one week after the last tail-bleeding severing the carotid artery and bleeding the hog to death. The blood secured at each bleeding is defibrinated and the fluid portion, consisting of a mixture of red blood cells and serum, is preserved in sterilized glass bottles, a small percentage of carbolic acid being previously added as a preservative. Before use all of the serum obtained from one immune is mixed together. In fact, as the potency of all serum should be tested before being employed in practice, considerable saving will be effected by mixing together in a large container the serum obtained from a number of different immunes, and then testing the potency of the mixture.

Determination of the Potency of the Serum.

The protective power of this serum may be roughly determined as follows:

Inject eight pigs, weighing from 30 to 60 pounds each, subcutaneously with 2 c. c. of blood from an acute case of hog cholera. At the same time give two of the pigs 10 c. c. of the serum on the opposite side of the body; give two 15 c. c. and two 20 c. c. in the same way. This will leave two untreated pigs, which serve as controls on the virulence of the blood. If the two pigs which receive only the diseased blood die, those that receive 10 c. c. of serum sicken, but recover, while those receiving the larger doses of serum remain well, the serum should be suitable for use in practice in doses of 15 cubic centimeters. As a matter of fact, it has been found that all immunes properly hyperimmunized will yield a serum which is sufficiently potent in doses of 20 c. c., and it is considered best to use this dose of serum for protecting pigs weighing between 20 and 100 pounds, even though certain lots of serum may appear to be somewhat more potent. Carrying out this idea of always using a dose of 20 c. c. for hogs weighing from 20 to 100 pounds, it is only necessary, in standardizing, to determine the action of a serum in a dose of 20 c. c.; if shoats do not sicken after a simultaneous injection of disease-producing blood and 20 c. c. of serum, the serum may be considered suitable for practical use. Of course, care is necessary to avoid misleading results. Susceptible pigs must be used for the test and the disease-producing blood must be of undoubted virulence, as shown by its effect upon pigs which receive no serum.

Methods of Vaccination.

After the serum has been obtained and tested in the manner indicated above, it is ready for use in immunizing susceptible hogs against hog cholera. This immunization is carried out in the following manner:

INJECTION OF SERUM ALONE.

The hogs it is desired to protect are injected subcutaneously with the proper dose of serum as determined by the preliminary test. If these animals are now exposed immediately to virulent hog cholera along with others which have not been treated with the serum, it will be found that the serum-treated animals will survive, whereas untreated animals subjected to the same exposure will succumb. This serum injection has been found to confer an immunity which will last for three weeks, though probably not very much longer.

If, however, the hogs which are given serum alone are exposed to hog cholera before the end of three weeks, they will acquire an im-

munity which will last for life. Just why the immunity in these serum-treated hogs is so greatly prolonged by exposure to disease is not definitely known, though there is good reason for believing that the serum-treated hogs contract a very light form of the disease under these conditions, being thereby rendered immune for life. In order to secure a lasting immunity following the injection of serum alone, it is therefore necessary to expose the serum-treated hog to hog cholera within two or three weeks after injection. In practice this method of vaccination would be suitable in cases where only a temporary protection is required, and also in the case of hogs which will in all probability be exposed to hog cholera within a very short time after receiving the serum. For example, the existence of hog cholera in a herd is frequently discovered before the infection has become general, many of the hogs being apparently well at the time; if the apparently healthy hogs are treated promptly in such cases, a large percentage of them may be saved, and as a result of their association with the sick ones they should acquire a permanent immunity.

SIMULTANEOUS INJECTION OF SERUM AND DISEASE-PRODUCING BLOOD.

In order that a permanent immunity may be secured as a direct result of vaccination, and without subsequent exposure to disease being necessary, a second mode of vaccination, known as the "serum-simultaneous" method, has been adopted. This consists in injecting the tested serum as previously described, and at the same time injecting a small quantity of disease-producing blood subcutaneously on the opposite side of the body. It is believed that this method of vaccination produces an immunity which lasts for life, and actual experiments have shown that hogs vaccinated by this method and not subsequently exposed to hog cholera until six months have elapsed were at the end of that time still perfectly protected. The serum-simultaneous method may be used to advantage on herds where the disease has already broken out, for experiments have shown that the use of the virus with the serum under these conditions does not make matters any worse but insures a prolonged immunity in the hogs which are not attacked by the disease.

SAFETY OF THE METHODS.

It has been previously shown that we may immunize hogs in either of two ways: (1) By injecting the serum alone or (2) by injecting a small amount of disease-producing blood along with the serum. The serum used alone, if properly prepared and preserved, is entirely harmless and incapable of giving rise to an attack of hog cholera, and does not interfere in any way with the growth of the treated hog.

The serum-simultaneous method, involving as it does the use of a disease-producing virus, requires much more careful use than does the serum alone. If the serum which is employed in conjunction with the disease-producing blood in the simultaneous method should not be properly prepared, injury to the vaccinated hogs might result from the treatment. This danger, which is extremely slight when a carefully tested serum is used, is met with in practically all processes now employed for producing a permanent active immunity against infectious diseases, and while it would be very desirable to eliminate entirely this element of danger, we can hardly expect to do this without at the same time sacrificing to a greater or less extent the high degree of immunity and the long period of protection afforded by the serum-simultaneous method in its present form. In deciding which method to use in practice one must be governed largely by the duration of immunity which is required. If this is only needed for a few weeks, or if the treatment can be repeated at short intervals, as in the case of exceptionally valuable pure-bred hogs where the increased cost of this plan would not be objected to, the serum alone may be used; in other cases the serum-simultaneous method is recommended.

The serum-simultaneous method should be applied only by competent veterinarians, whose duty it should be to see that reliable serum is used. After treatment the herd should be kept under observation for ten days or two weeks and if any of the inoculated hogs should show serious symptoms of disease the herd should be immediately re-treated with serum alone. When properly performed the serum-simultaneous method does not seem to injure the hog or to interfere with its growth in any way, and if the precautions indicated above are taken it is regarded as safe for use in practice.

PRACTICAL TESTS OF THE SERUM.

Serum prepared by the methods described above has been tested over and over again on hogs in small pens and in large herds on farms under practical conditions, and in all cases its very marked protective power has been demonstrated. In the year 1907, after the value of the serum had been established as far as was possible in an experimental way, an extended practical test was conducted. This practical test was planned to secure information along several lines, as follows: (1) The value of the serum for protecting herds in the neighborhood of disease, but not actually exposed at the time of treatment; (2) the value of the serum for preventing the occurrence of disease in herds known to have been exposed through association with diseased hogs, but not yet showing symptoms of hog cholera; and (3) the value of the serum for checking the disease in herds where it

had already broken out. The details of this practical test have been already published, so that only a brief summary of the results will be given here.

Results of the Tests.

In all approximately 2,000 hogs were vaccinated, these being located on 47 different farms in central Iowa. When an experiment was instituted to determine the protective power of the serum on herds which had not been exposed, a considerable proportion of untreated hogs was left in the herd to serve as controls on the efficacy of the vaccination. If these untreated hogs became sick, whereas the vaccinated hogs remained well, we would know that the vaccination was efficient. In the case of trials on other farms where the herds had been exposed, or where disease already existed, the plan of leaving a number of untreated hogs was always followed. The results of this test were briefly as follows:

(1) In a majority of the herds which had not been exposed at the time of treatment the disease did not appear in any of the hogs, either treated or controls. In a few of these herds, however, hog cholera appeared among the controls some weeks after vaccination, the average loss in such cases being 68 per cent of the controls, while of the treated hogs in these same herds and associating with the sick control animals none died.

(2) Several herds were found which had been exposed to disease, generally through the entrance of a hog which had escaped from a neighboring diseased herd, but in which there were no signs of disease at the time the herd was treated. In these exposed herds 4 per cent of the treated hogs died, while more than 89 per cent of the untreated control animals succumbed.

(3) The serum was used on a considerable number of herds where hog cholera already existed, the endeavor being made to treat only those herds where the disease had not progressed very far, as past experience had shown that the serum could not be expected to save a very large proportion of hogs which had been sick long enough to exhibit marked symptoms of the disease. As a rule, this third class of herds contained comparatively few sick hogs, but yet a sufficient number to show plainly that hog cholera was present, this being confirmed by post-mortem examination of one or more of the diseased hogs. In this third class of herds 75 per cent of the untreated controls died, while only 13 per cent of those that received the serum were lost.

COOPERATION WITH STATE REPRESENTATIVES.

Following this practical test of the serum representatives of all of the States were invited by the Chief of the Bureau of Animal Industry to visit the experimental farm in Iowa, where the serum was being made, for the purpose of seeing the methods in actual operation. In response to this invitation representatives from twenty-five different States visited this farm and many of these have since taken up the work of producing the serum. The reports received from those who have tested this method thoroughly show that the results have been uniformly gratifying.

POSSIBILITY OF ELIMINATING THE MENACE OF HOG CHOLERA.

In view of the findings briefly set forth in this paper, we regard it as definitely established that blood serum from immune hogs, which have been previously hyperimmunized, will protect susceptible hogs from hog cholera. If this serum is widely used there is every reason to believe that the enormous losses which result yearly from hog cholera will be materially reduced and there is the possibility that by thorough, systematic work the disease may be eliminated as a serious menace to the hog-raising industry.

THE MANUFACTURE OF FLAVORING EXTRACTS.

By E. M. Chace,

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NATURE OF FLAVORING EXTRACTS IN GENERAL.

The flavoring extract, as we know it, is a product peculiar to America. While all civilized countries are familiar with the flavors employed in the manufacture of flavoring extracts, few, if any, use them as they are used in this country. A flavoring extract, to quote from the standards established by the Secretary of Agriculture in 1906, "is a solution in ethyl alcohol of proper strength of the sapid and odorous principles derived from an aromatic plant, or parts of the plant, with or without its coloring matter, and conforms in name to the plant used in its preparation." This definition at once excludes all preparations which are not solutions in alcohol and eliminates the various forms of prepared flavored sugars used abroad.

Extracts were at first considered almost exclusively as pharmaceutical products, being used partly in medicines and partly in foods by housewives and confectioners. For many years formulas for the preparation of such extracts appeared in the Pharmacopœia, but these have now been omitted, as the demands of the food and confection trade far exceed all others.

The two principal flavors are vanilla and lemon, it being estimated that more than 95 per cent of the flavoring extracts manufactured are of these two varieties. With few exceptions the other flavoring extracts are artificial, it being impossible to manufacture an acceptable extract from the fruit itself. Orange, peppermint, and wintergreen extracts are among the exceptions to this rule, while the strawberry, pineapple, peach, and some others are always artificial.

ORIGIN AND CULTIVATION OF THE VANILLA BEAN.

There is at least three times as much vanilla consumed as of all other flavors together, and in all probability the consumer knows less of its origin than of any other material from which extracts are made, few being familiar even with the matured vanilla bean.

The plant from which this fruit is gathered is a native of the southeastern portion of Mexico, where it was used by the natives for the

purpose of flavoring cocoa when that country was conquered by the Spanish under Cortez. It was first described by a Franciscan friar, Bernhardino de Sahagan, in 1575, and for years was supposed to be of great medicinal value. For this reason many attempts were made to cultivate it in Europe, but with absolutely no success. Its cultivation in tropical countries, however, has since attained great magnitude, but in all cases the product has fallen short of the superior flavor of the native Mexican bean. It is now grown commercially in the East Indies (especially Java), Réunion, Mauritius, and the Tahiti islands. The Mexican product, however, still retains its superiority and brings a considerably better price than any of its descendants, in some cases the transplanted bean being decidedly inferior, as in the case of those from Tahiti.

The plant itself is a vine belonging to the family of orchids, the *Vanilla planifolia* Andrews being the species usually cultivated. It thrives only in the Tropics, the mean annual temperature of the countries of its production averaging over 80° F., with an average rainfall of approximately 38 inches. Some credence seems to be given to the theory that the vine requires the dense shade of a tropical forest, owing probably to the fact that its support when growing wild was the forest tree. Trees are generally used as supports when the plant is cultivated, more, however, because they are readily available than for any other reason. The plants bear when three years old and continue bearing for thirty years or more. Little difficulty seems to be encountered in the cultivation of the vanilla bean, although the vine is subject to the usual attacks of insects and disease.

ARTIFICIAL POLLENIZATION OF THE VANILLA BLOSSOM.

An interesting incident in the growth of the fruit is the artificial pollenization of the flower. The original cultivators depended solely upon insects to carry the pollen from blossom to blossom. The results were naturally unreliable, some vines being made to bear too many pods, others too few, resulting in a loss in both quality and quantity of the fruit produced. To overcome this difficulty the modern planter pollenizes by hand. The process, an exceedingly simple one, is carried out by removing the pollen from the male flowers by means of a small wooden splinter about the size of a toothpick and placing small portions of it in the female flowers. (A similar method is used by producers of hothouse fruit in this country.) As the flowers open during the night and close before midday, this work is done in the early morning and is most successful if completed on the first day on which the flower blossoms. If not successfully pollinated, the flower soon withers and falls; thus the number of pods which each vine is maturing can be seen at a glance and can be controlled according to its age and strength.

HARVESTING AND CURING THE VANILLA BEAN.

The pods mature in from six to seven months after the flowering period, becoming slightly hard and turning yellow at the lower end, whence thin yellow stripes run upward. This is a critical point in the production of the high-grade bean, great experience being necessary in order to detect the proper state of maturity for gathering. If the pod is picked when too green, the flavor when cured is inferior, and, furthermore, the bean is susceptible to mold. When it remains too long upon the vine it splits while curing and sells at a lower price. At the gathering time the bean has neither an agreeable odor nor flavor, both qualities being developed by the curing process. When allowed to become fully dry upon the vine, the bean does develop an odor and a flavor, but both are so inferior to those obtained when it is properly cured that the product thus obtained is almost worthless.

A different curing process seems to be in use in each locality; indeed, in most cases each planter has his own particular method. There is some disagreement among experts as to the exact nature of the change which vanilla undergoes in the curing process. By some it is contended that the change is merely one brought about by drying, while others assert that the bean undergoes a fermentation not unlike that to which cocoa is subjected. The simplest method in use is that common in Mexico, where the pods are allowed to lie in the sun for several hours until thoroughly heated, when they are wrapped in blankets and left until the following day. The heating, followed by storage, is repeated on several successive days until the greater part of the moisture has been evaporated. This procedure is, of course, often varied, it being a common practice to coat the beans with secret preparations, composed principally of animal or vegetable oil, to promote the sweating which takes place while wrapped in blankets. The excess of moisture is sometimes removed by manipulating the beans with the hand, and many other devices are used to develop the desired flavor. In the French colony of Réunion the beans are subjected to a scalding bath immediately after picking; thus wilted, it is claimed that the subsequent fermentation, desiccation, and manipulation are greatly aided.

In all localities artificial drying has now largely replaced exposure to the sun, thus shortening the time consumed in curing and giving a more even product.

GRADING AND STORAGE OF VANILLA BEANS.

When the beans are finally ready for shipment they are sorted according to length, those which have split or become otherwise defective being separated. The former are sold as "splits;" the latter, after having the defective portion removed, are known as "cuts,"

both being lower priced than the whole bean. The beans when properly prepared and stored may be preserved for several years. After a short period of storage the East Indian varieties become covered with a white coating, or what is generally known as a frosting of vanillin crystals. A like crystallization takes place with the Mexican varieties, but to a much less extent, for, while of superior flavor, the Mexican bean contains less vanillin. Although it is generally conceded that the principal flavoring agent of all varieties is vanillin, it is certainly true that other compounds give the fine bouquet to the Mexican bean which enables it to command the highest market price. The beans, which are now dark brown, are purchased and stored in large quantities by the dealers in this country. It is necessary to go over the stored material every few weeks and remove the bundles which show signs of mold or other infection. (See Pl. XXVI, figs. 1 and 2.)

THE MANUFACTURE OF HIGH-GRADE AND LOW-GRADE VANILLA EXTRACTS.

The task of converting the bean into extract of the first quality is exceedingly simple. An ounce of the beans, finely cut by machines, is allowed to soak in 10 ounces of a mixture consisting of equal parts of grain alcohol and water. In the majority of cases the extract is poured off from the exhausted beans in a few days, bottled, and shipped to the retail dealer. A very few manufacturers allow the mixture to remain for months in casks which have been used for this purpose many years. The theory that this treatment produces a superior bouquet is often denied, but the producers of the highest grade of extract still continue its use, despite the fact that the loss through evaporation and the delay in returns from the capital invested is considerable.

Cheaper extracts are made from low-grade beans, using less alcohol, the flavor and body of the product obtained being inferior. Small quantities of essential oils, and even musk, are used to supply flavor, and glycerin and sugar are added to give body. The latter substances are allowed by the standards, sugar being required by the United States Pharmacopœia formula.

In testing vanilla extracts the chemist bases his judgment of the purity of the sample largely upon the amount of vanilla resins which are present. Many of the cheaper grades are made in alcohol so dilute that the resins of the bean are not dissolved, and in order to produce the required amount various expedients are used. One of the most common is to heat the bean under pressure with glycerin; another is to treat the resins with alkali, rendering them soluble. Not a few manufacturers make use of the various forms of soluble oleo-resins of vanilla which are manufactured by large drug houses.

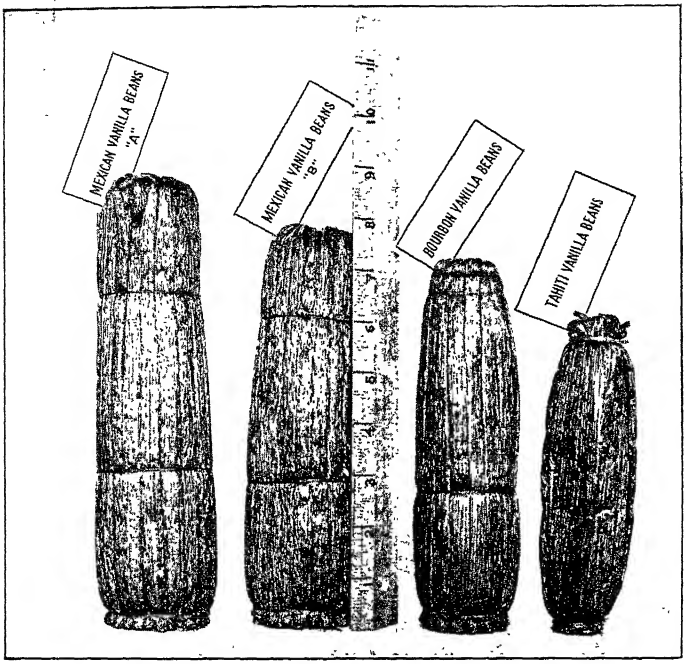

FIG. 1.—MEXICAN, BOURBON, AND TAHITI VANILLA BEANS.

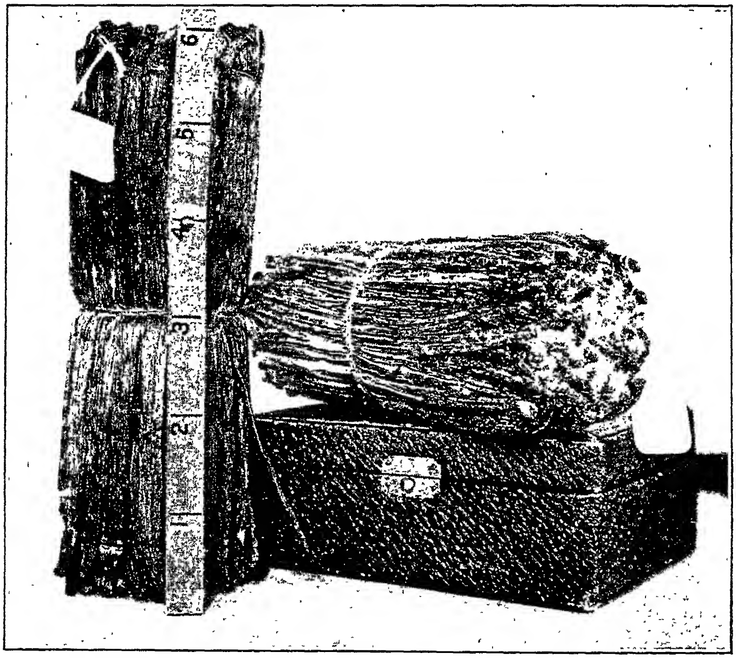

FIG. 2.—BOURBON SPLITS AND BEANS, SHOWING FROSTING.

FIG. 1.—CUTTING THE LEMONS, MASCALI, SICILY.

FIG. 2.—REMOVING THE PULP OF LEMONS, MASCALI, SICILY.

FIG. 1.—EXPRESSING LEMON OIL, TWO-PIECE METHOD, MASCALI, SICILY.

FIG. 2.—EXPRESSING LEMON OIL, TWO-PIECE METHOD, MESSINA SICILY.

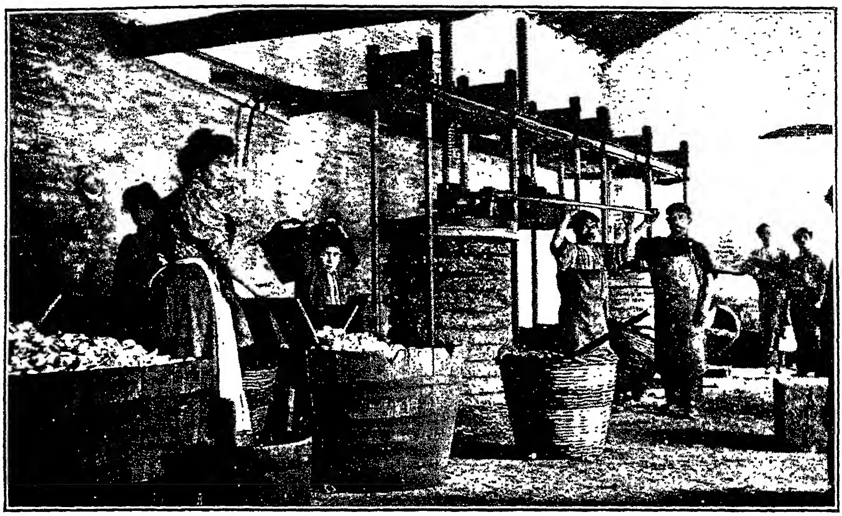

FIG. 1.—INTERIOR OF LEMON-OIL FACTORY, NEAR MESSINA, SICILY.

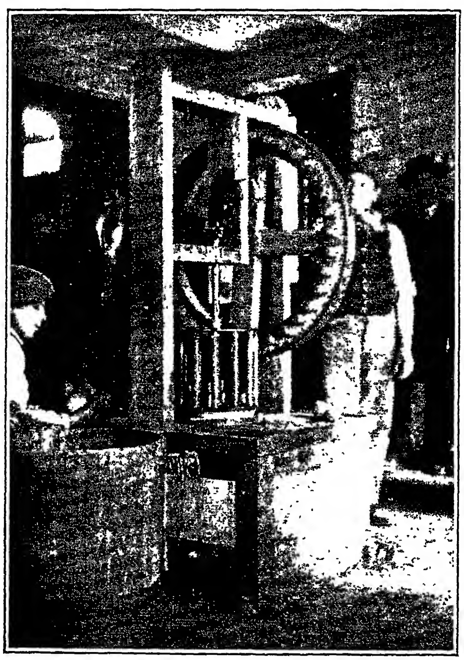

FIG. 2.—LEMON-OIL MACHINE, REGGIO, CALABRIA.

The cheapest form of extract contains no vanilla, being made from the artificial vanillin, extract of tonka, or artificial coumarin. All of these products have strong odors and flavors, but none of the bouquet of the genuine bean. Such extracts usually contain prune juice, caramel coloring, sugar, glycerin, and other products to modify the flavor. The Federal food regulations prohibit the entry of such products into interstate commerce unless labeled "Artificial," "Imitation," or "Substitute," and almost all State laws require the same labeling.

SOURCES OF LEMON OIL.

Lemon extract ranks second only to the vanilla in point of the quantity consumed. It is made by dissolving the oil of lemon (5 parts) in strong alcohol (95 parts). Oil of lemon is the essential oil secreted by cells lying near the outer surface of the lemon rind. The similar oil found in orange peel is better known and to it is due the burning sensation felt when the skin is placed in the mouth. The world's supply of lemon oil comes from the island of Sicily, situated off the southwestern point of Italy, in the Mediterranean Sea. This island is the greatest lemon-producing region of the world, and large quantities of the fruit are shipped from it to all parts of Europe and to the eastern section of North America. The oil is produced as a by-product of this industry from the cull lemons. When the fruit is gathered it is carefully sorted and the lemons which for any reason will not stand shipment are sold to the lemon-oil factories.

THREE PROCESSES FOR EXTRACTING LEMON OIL.

There are three different processes in use for obtaining the lemon oil, two of which are known as sponge methods and the third as the machine method. The two-piece sponge method is the one generally used, in which the fruit is cut in half before separating it from the pulp. In the other the rind pared from the fruit is in three pieces. Less than 5 per cent of the lemon oil produced is made by machine, the use of which is confined to the coast of Calabria, on the Italian mainland.

THE TWO-PIECE SPONGE METHOD.

In the first-mentioned method the lemons are cut in halves by children or women, the cheapest form of labor. An ordinary paring knife is used, and the fruit is divided from end to end or crosswise, the former method being employed usually only when it is intended to make some use of the skin after extracting the oil. The work is carried on with great rapidity, the knife being started through the rind and the lemon cut in two and thrown into storage tubs by one motion of the arm. The tubs containing the cut fruit are dumped

into shallow troughs, where the pulp is separated from the skin. Older girls and women are employed for this work almost exclusively. A spoon-shaped instrument is inserted between the pulp and rind, and with one twisting motion forced toward the end of the fruit, when, with a quick jerk, the pulp is pulled from the rind and deposited in the trough. The rinds are thrown into baskets, and before being carried to the spongers are thoroughly soaked in water, usually by immersing the entire basket in a large tub or reservoir, and shaking off the excess. They are then allowed to stand four or five hours, or even over night. (See Pl. XXVII, figs. 1 and 2.)

The work of expressing the oil is done entirely by men, women being rarely employed, as the work is quite laborious. The workers sit upon low stools, the skins being dumped upon the floor in front of them and a basket for the exhausted skins set a little to one side. A small earthenware bowl, 8 to 10 inches high and of about the same diameter, is placed on the floor between the workman's knees. This bowl has at one side a lip, directly beneath which is a small concave depression, which serves to hold back the residue when the oil is poured from it. Across the top is placed a round stick of wood about an inch in diameter, so notched as to fit the widest part of the bowl. Across this stick is hung a flat sponge surmounted by another thicker one and finally a third, which is cup-shaped, into which the lemon skin is inserted with the right hand, the left being used to press upon the sponge, the weight of the whole body being thrown into the motion. The lemon rind is then turned partly over and the pressure renewed. This is repeated three or four times, after which the skin is thrown into the waste basket. Each half rind is handled separately, receiving three or four pressings. (Pl. XXVIII.) From 1,600 to 2,200 of these halves produce only 1 pound of oil, the quantity depending upon the size, ripeness, and freshness of the fruit. It is said that green fruit produces rather more oil than ripe, and that the lemons should be worked up as soon as possible after picking. A good workman can produce between 2 and 3 pounds of oil per day, for which he receives from 40 to 60 cents.

By the two-piece method only a small quantity of water is expressed with the oil and the process of separation is very simple, the bowl being tilted forward until the oil can be blown from the surface over its edge into another receptacle. The water and residue remaining are separated from the traces of oil by the same means and finally filtered through felt bags. The residues left in these bags are collected for several days, when the bags are placed under a hand press and freed from the last traces of oil. The oil resulting from the filtration of the residues (called "fece") is of very low quality, with a decidedly disagreeable odor. It is not sold separately, but mixed with large consignments of the pressed oil.

THE THREE-PIECE SPONGE METHOD.

The three-piece method differs from the one just described mainly in the preparation of the skins before pressing. The rind is pared off in three slices, leaving the greater part of the pulp with some little rind at the ends. The paring, as a rule, is done by boys or men and the skins are washed or soaked, as in the two-piece method. The method of sponging differs only slightly; the pieces being smaller are not inserted in a cup-shaped sponge, but are pressed flat against a large sponge placed over two others, as in the first method. The earthenware bowl is always used and sometimes the oil is pressed directly into it; in other cases it is supplemented by setting a white glazed bowl on top of it. The sponge stick is fitted to this and the oil received directly, the larger bowl being then used only for the separation of oil and residual juice. Much more pulp is left adhering to the skins by this method of procedure and therefore much more juice is expressed with the oil than by the other method. The claim is made, however, that oil made in this way filters more rapidly and remains clear longer. The explanation given is that, more of the oil-soluble materials being coagulated by the citric acid, they are more easily removed and do not precipitate later.

MACHINE METHOD.

The use of machines in producing lemon oil is confined to the Province of Calabria, the oil thus produced forming but a very small part of the total product. It has more color than the sponge oil and is used to deepen the color of the latter when produced late in the season. The machine is extremely crude. The lemons, about eight in number, which must be of a uniform size, are placed in the receptacle between the grinding disks, the lower of which is stationary, while the upper one is turned by an arrangement of wooden cogs against the side flywheel. The pressure exerted by the weight of the upper disk is partly compensated for by the arm at the rear, which is also used to raise this part of the machine, so that the fruit may be placed in position and removed. A small bell rings after a given number of revolutions, usually about one-half minute being required to remove the oil-bearing part of the lemon skin. The fruit is then removed and carefully wiped with a sponge, the greater part of the oil and gratings having been collected in a receptacle placed under the lower disk. The mixture is filtered through cloth filtering bags, the water and oil being separated by blowing the latter from the top. The filter bags containing the final residue are pressed under hand presses similar to those used in Sicily. (Pl. XXIX.) The oil produced is of a deep rich yellow color and is used solely for the purpose of bringing up the color of pale oils. It is finally filtered through filter paper, stored, and shipped in copper containers.

MANUFACTURE OF THE EXTRACT FROM LEMON OIL.

The process of making the extract from the oil in the case of the ordinary extract is extremely simple. The oil is dissolved in strong alcohol in the proportion of 5 parts oil to 95 parts alcohol; it is then filtered and bottled. Sometimes a small amount of coloring is added, as this solution has but a faint yellow tint. The formula of the Pharmacopœia prescribes lemon peel for coloring, but unfortunately the color thus obtained fades in the course of a few weeks, so that the trade has turned to other sources, using chiefly turmeric and anilin dyes. The chief cost in the production of such an extract is the alcohol, which must be relatively strong (not less than 85 per cent pure) in order to retain the 5 per cent of lemon oil in solution. With lemon oil at $1 per pound and alcohol at $2 per gallon, the latter represents over 90 per cent of the cost of material.

METHODS OF PRODUCING LOW-GRADE LEMON EXTRACTS.

The cost can be practically halved by the production of a terpeneless extract, which can be made in three ways: (1) By the solution in dilute alcohol of the so-called terpeneless oil of lemon; (2) by solution in strong alcohol of oil of lemon and then diluting and removing the oil which separates out; and (3) by washing lemon oil with dilute alcohol. The first method is seldom used; the second and third have been quite common, each having some advantage over the other. By each of the latter treatments the principal flavoring agent of the oil, the citral, is removed and there remain undissolved the terpenes, which constitute about 90 per cent of the oil. The terpenes as thus obtained still retain some citral, and have therefore some flavoring value. It is often claimed that they are made up into extracts and sold to bakers. Many of the cheaper products on the market are merely weak alcoholic washes made by repeatedly shaking the oil with dilute alcohol (about 20 or 30 per cent pure). They have something of the odor of a good extract, but are worthless when used for baking purposes. At times these extracts are flavored with citronella, and strengthened with lemon-grass citral containing glycerin, sugar, and other substances to give body and flavor.

ORANGE EXTRACTS.

True orange extracts are made by dissolving oil of orange in strong alcohol. This oil is manufactured by a process identical with that used for lemons, and practically the whole output, as in the case of lemon oil, comes from Sicily. The same problems of manufacture are encountered as with lemon extracts, but the production of cheaper grades is not so extensive, the demand for orange extract not being sufficiently large.

PEPPERMINT AND WINTERGREEN EXTRACTS.

Almost the sole use of peppermint and wintergreen flavors is in confectionery, and but few extracts appear on the general market. Both of these flavors are products of American soil. Peppermint is grown largely in southern Michigan and northern Indiana and in Wayne County, N. Y. Wintergreen is produced chiefly around White Haven, Pa., although there are other districts which distill quite large quantities. The methods of production for these oils are very similar. In the case of peppermint, which is a cultivated crop, the plant is mowed and placed in large vats. These vats are provided with false perforated bottoms and are capable of being tightly closed at the top. After the mint plants are placed in the vat they are thoroughly trodden down, the top is fitted on, and steam is turned into the false bottom. The steam ascends through the mint in the vat and is carried off through a pipe at the side. This pipe is run through a trough of cold water or some other form of condensing apparatus in which the steam and peppermint oil are condensed. The resulting liquid consists of two layers, the lower or water layer being automatically drawn from the bottom of the receptacle and the upper layer of oil finally freed from the last traces of water by filtration through cotton.

In the distillation of wintergreen the plant is placed in a copper kettle containing water, fitted with a top connecting with a worm still. The water is boiled off and the vapors condensed. In this case the distillate also forms in two layers, the lower of which is wintergreen oil. It is separated by removing the upper layer of water and filtering through cotton. The extracts of both peppermint and wintergreen oils are made by dissolving them in alcohol. As placed upon the market they are usually artificially colored, as the pure extracts are almost colorless. Oil of birch and synthetic methyl salicylate are used largely to replace wintergreen oil in such products.

ALMOND EXTRACT.

This flavor is prepared by making a solution of oil of bitter almonds in strong alcohol, and in order to comply with the official standards must contain at least 1 per cent of the flavoring material. Almond oil is derived principally from the seeds of the apricot, although considerable amounts are obtained from almonds and peach kernels. The oils obtained from these different sources are very similar and are universally known as oil of bitter almonds. In its preparation, the kernels are ground and subjected to high hydraulic pressure in order to free them from the fatty oil which they contain. The residues are then reground, fermented, and finally distilled with steam. The resulting product contains a highly poisonous substance,

hydrocyanic acid, which must be removed before it becomes available for the preparation of extracts. This is accomplished by treatment with lime and copperas, which reagents remove the last traces of the impurity.

Artificial extracts are prepared from synthetic benzaldehyde, a coal-tar product. The flavor of both products is that often obtained by the housewife by the use of bruised peach leaves.

IMITATION EXTRACTS.

As has been said, it is impossible to prepare several of the common flavors from the original fruit. When such is the case, resort is had to the synthetic product most nearly corresponding to the genuine flavor. This flavor in most cases is due to a class of chemical bodies known as esters or ethers which are produced in the growth of the plant. Commercially, the same bodies are manufactured from fusel oil and other higher alcohols. Each flavoring-extract manufacturer has his own secret formula for the preparation of each class of extracts; the predominating ester in each case is, however, usually the same, acetic and butyric ethers being most commonly employed. This class of extracts is usually colored with coal-tar products, and the Federal and most of the State laws require that they be labeled "Imitation," "Artificial," or "Substitute."

THE RELATIONS BETWEEN BIRDS AND INSECTS.

By F. E. L. Beal,

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INTERACTIONS OF PREDACEOUS SPECIES AND THEIR PREY.

The interactions of animals and plants upon each other and their relations to their inorganic environment present some of the most complicated problems that can occupy the attention of the philosopher and scientist. It is a well-recognized fact that any cause acting upon one group of animals or plants creates a change of some kind in other groups with which the first is in relation. The relations between species or groups are rarely more intimate than when one preys upon the other. If, through any cause, predaceous species become abnormally abundant, the species more extensively preyed upon will be reduced in numbers, and conversely, if predatory species become less numerous, the species they prey upon will increase in numbers.

Birds and insects constitute two groups so related, and as the latter include some of the worst pests with which the farmer has to deal, it may be profitable to study some of the relations between the two.

INSECTS THE CHIEF FOOD OF MANY BIRDS.

For centuries it has been a matter of general observation that the common singing birds subsist largely upon insects, and in modern times it has come to be generally understood that insects form one of the most important items of food for the great majority of birds. This has been confirmed by careful scientific investigation. Many species are now known to live almost wholly on insects, and in some large groups of species the average quantity of insects consumed forms a high percentage of the whole food. In the family of woodpeckers, for instance, insects form over 65 per cent of the yearly food. In the California flycatchers examined, insects formed 96 per cent of the food; in the warblers of the same State, 94 per cent; and in the wrens, 95 per cent. On the other hand, the stomachs of a large number of sparrows and finches from the Pacific coast contained an average of only 12 per cent of insects, while those of a like number of eastern sparrows and finches contained about

25 per cent of animal matter. Insects, however, constitute the larger part of the food of shore birds, the cuckoos, the goatsuckers, the swifts, the swallows, the vireos, the creepers, and the titmice; while in the stomachs of the crows and jays, the blackbirds and orioles, and the thrushes, the amount of animal and vegetable food is nearly equal. Many of the game birds and the smaller birds of prey eat a considerable amount of insects, especially during the breeding season.

While no series of stomachs of any species has yet been examined that did not contain some vegetable matter, it is probable that in many cases this element is purely accidental. When insects are picked from the ground, or from plants, small seeds or bits of leaves are easily taken and swallowed at the same time. In the case of the western yellow-throat, animal food amounted to 99.77 per cent of the whole contents of the stomachs, which shows the insignificance of the vegetable part, and tends strongly to prove that plant food was not sought at all, but was taken by chance with an insect morsel.

BIRDS THE MOST IMPORTANT CHECK UPON INSECTS.

In view of the above facts, one is impressed with the conviction that the avian tribes must exercise an important influence upon the relative abundance of insects. That birds are an efficient check upon insect multiplication seems impossible of denial, and it is doubtful if anywhere in the animal kingdom any other restraining influence so important can be found. A predatory insect, for instance, actually destroys at best only a comparatively small number of insects each day; parasites, indeed, may deposit eggs in several hundred hosts, each of which eventually will be destroyed, so that under favorable conditions they may perform a very efficient service in checking the increase of insect pests. In many cases, however, the parasite does not prevent the immediate harm done by its host; it only prevents a future generation.

To illustrate the destructive capacity of birds it may be mentioned that from 3,000 to 5,000 insects have been found in a bird's stomach at one time. It is true that birds are not so numerous as are the predatory and parasitic insects, but it is doubtful if this disadvantage is sufficient to overcome the advantage of greater size, with corresponding capacity for destruction.

Another point in favor of birds is their ability to travel long distances, so that in case of a local outbreak of any species of insect they are able to rally quickly to the spot and render good service in checking the further increase of the pest. On this point Professor Forbes says:

> Especially does the wonderful locomotive power of birds, enabling them to escape scarcity in one region which might otherwise decimate them, by simply

passing to another more favorable one, without the loss of a life, fit them, above all other animals and agencies, to arrest disorder at the start—to head off aspiring and destructive rebellion before it has had time fairly to make head.[a]

INSTANCES OF EFFECTIVE WORK BY BIRDS.

That they do so is proved by numerous instances. Professor Forbes has shown that in an orchard badly infested with canker worms birds were abnormally abundant and had added to their usual food a very considerable quantity of these insects, as was shown by comparing the contents of their stomachs with those of others of the same species taken at other places.

Mr. O. E. Bremner, in a letter to the Biological Survey, dated at San Francisco, March 16, 1908, says:

> The canker-worm episode is quite a common one with us here. In one district * * * there has been a threatened invasion of the prune trees several times, but each time the [Brewer] blackbirds came to the rescue and completely cleaned them out. I have often seen bands of blackbirds working in an infested orchard. They work from tree to tree, taking them clean as they go. If a worm tries to escape by webbing down they will dive and catch him in mid-air.

When the Rocky Mountain locust invaded the fertile plains of the Mississippi Valley, Professor Aughey found that it was preyed upon by every species of land bird, and even by some water fowl. Birds that normally fed upon other food, attracted by the unusual abundance of these insects, ate them freely and continuously while they lasted. The above facts prove that birds are attracted by an abundance of food; and that propinquity as well as palatableness has some influence on the selection.

USEFUL AS WELL AS HARMFUL INSECTS EATEN BY BIRDS.

The point has been raised, however, that in the matter of insect consumption birds are indiscriminate, and eat insects without regard to species or to their economic significance. It has been asserted that in devouring useful insects birds counteract all the good they do by eating harmful ones. It is quite true that they destroy many useful insects. The Carabidæ, or predaceous ground beetles, are eaten by the ground-feeding birds, especially in the spring, when the birds first return from their southern migration. The useful parasitic Hymenoptera are eaten by flycatchers, and form a very respectable percentage of the food of some species. While at first sight this may appear to be an argument against the usefulness of birds, a

[a] S. A. Forbes, On Some Interactions of Organisms. Bull. Ill. State Lab. Nat. Hist., vol. 1, No. 3, p. 12, 1880.

broader philosophy will show that it is exactly what they should be desired to do.

> Against the uprising of inordinate numbers of insects, commonly harmless but capable of becoming temporarily injurious, the most valuable and reliable protection is undoubtedly afforded by those predaceous birds and insects which eat a mixed food, so that in the absence or diminution of any one element of their food their own numbers are not seriously affected.[a]

Whoever expects to find in birds beneficent organisms working with a sole view to the benefit of the human race will be doomed to disappointment. Birds eat food to sustain life, and in their selection are guided entirely by considerations of their own. If all species of insectivorous birds be considered as a whole, it is found that they eat insects of the various species in about the proportions in which these species exist in nature. But it must not be inferred that each species of bird eats all kinds of insects to the same extent. Flycatchers and swallows, which take the greater part of their food upon the wing, eat largely of Hymenoptera, Diptera, and flying Coleoptera—insects which spend most of the daylight hours in flying about, and so fall an easy prey to the more agile species of birds. Ground-feeding birds, like robins, meadowlarks, and blackbirds, find and feed upon the predaceous ground beetles and other terrestrial Coleoptera and grasshoppers; cuckoos, orioles, warblers, and vireos find most of their food among the leaves of trees, and so destroy caterpillars and leaf-eating beetles; titmice, nuthatches, and creepers scramble over the trunks and larger limbs of trees, where they get insects' eggs, pupæ, hibernating insects, small moths, and some beetles; while woodpeckers dig into both sound and rotten wood, from which they secure wood-boring larvæ and ants.

It is probable that no species of insect is so completely protected by its habits of life that it is not found and preyed upon, at one or another stage of its existence, by some species of bird. Even in those cases where so-called "protective devices" have been developed, investigation of the contents of the stomachs of many birds has shown that they are effective only to a limited extent; that in spite of protective coloration, protective or mimetic forms, nauseous odors, acrid secretions, and defensive armatures, insects so protected are found and eaten by birds, and in many cases form a considerable percentage of the average annual food.

Thus among Hemiptera the Pentatomidæ have a most nauseous smell and taste, as many discover when they accidentally take them into the mouth with a berry; in fact they have received the vernacular name of stink-bugs. It is evident, however, that birds do not find them nauseous or in any way disagreeable, for they eat them freely;

[a] S. A. Forbes, On Some Interactions of Organisms. Bull. Ill. State Lab. Nat. Hist., vol. 1, No. 3, pp. 11–12, 1880.

in fact, few insects are found in the stomachs of so many species of birds and of so many individuals. Certain beetles, especially some of the Carabidæ, are noted for a strong caustic secretion which gives them a rank choking odor and causes a burning sensation on the tongue when taken into the mouth. These insects have been found in the stomachs of crows and some other birds. Two species of Chrysomelid beetles, *Chlamys plicata* and *Exema conspersa*, when they draw in their limbs and antennæ, so nearly resemble lumps of dirt or droppings of a large caterpillar that only by the closest inspection can they be distinguished as living creatures, yet both of them frequently appear in the stomachs of birds. Many if not all species of snout beetles will, if disturbed, "play 'possum," that is, fold up their limbs, press their snouts close to their bodies, and drop to the ground, where, in addition to being concealed by rubbish, they very closely resemble lumps of dirt or bits of twig. This resemblance, however, by no means always saves them from the keen eyes of the ground-feeding birds, and over 40 individuals of a single species have been found in the stomach of a blackbird. In fact the snout beetles as a group are among the insects most commonly found in birds' stomachs.

The Meloidæ, or blister beetles, are well known because they blister the skin when crushed upon it. So potent are they that they are used medicinally for the purpose of raising blisters. This property would seem to unfit them as food for birds or any other animal, but in fact birds eat them to a considerable extent, and as many as 14 have been found in a single stomach. The drug cantharadin which these beetles contain appears to have no deleterious effect upon birds.

Many caterpillars are covered with hairs, and some species have also stinging spines, evidently intended for defense against enemies. Hairy caterpillars are eaten freely by cuckoos and are frequently found in the stomachs of other birds. The larva of the Io moth is disagreeable to take in the naked hand on account of these stinging spines, yet seven of these larvæ were found in the stomach of a cuckoo.

BALANCE AMONG INSECTS MAINTAINED BY BIRDS.

From these considerations it would appear that the true function of insectivorous birds is not so much to destroy this or that insect pest as it is to lessen the numbers of the insect tribe as a whole—to reduce to a lower level the great flood tide of insect life. That this is the true relation of birds and insects should be inferred from the fact that the two have lived together for countless ages, and the balance of nature has been preserved except as disturbed by the opera-

tions of man. Birds have not wholly destroyed predaceous and parasitic insects on the one hand, nor on the other have they, so far as we know, exterminated any vegetable-eating pest, but they have successfully held the balance between the two, and kept both at such a level of relative abundance as has subserved the best interests of both the animal and the vegetable world; and it is only where man has interfered with this balance that oscillations have taken place which have resulted in damage to him and to the products of his labor.

Had birds preyed exclusively upon harmful—that is, upon vegetable-eating—insects, they, together with the predaceous and parasitic insects, might have completely exterminated their natural prey. In that case both birds and predatory and parasitic insects would be without their natural food, and in consequence must themselves perish, unless they could find some other source of subsistence. In the meantime, vegetation would have enormously increased, producing complications difficult to foresee. Fortunately birds eat insects indiscriminately, so that the two great opposing forces, the vegetable eaters and the birds and insects that feed upon them, are kept in a state of practical equilibrium. This is the ideal natural condition.

DISTURBANCES OF NATURE'S ADJUSTMENTS DUE TO MAN'S ACTIVITIES.

Man, however, when he settles in a new country, proceeds at once to overturn the natural equilibrium by cutting off the forests, plowing up the prairies, draining the marshes, or irrigating the deserts, thus producing marked disturbances in the animal and plant life. Some insects, deprived of their natural food, turn to the introduced plants, and in many cases find them more abundant and more palatable than their former food, and so thrive and increase rapidly. The birds, not being able to multiply with such facility, are unable at first to deal with the greatly increased supply of food, except to the extent that they increase by migration from surrounding territory. Moreover, the seed and fruit eating birds have, like the insects, suffered a loss of their natural diet, and so turn to the farmer's crops for their supplies. He, in turn, seeing his crops preyed upon on all sides, declares indiscriminate war upon all animal life; and as birds, being more conspicuous than insects, are more easily killed, he slays without consideration both those that feed upon his crops and those that prey upon the insect spoilers.

After years of misdirected effort, man is at last learning the lesson that Nature's adjustments are not to be lightly set aside; that when undisturbed by his influence each species maintains a certain normal maximum of abundance at which it does the most good and the least harm; and that its fluctuations either above or below this normal are temporary and local—from which it follows that his best efforts

should be directed to restore and maintain this harmony, and, in all places where he is obliged to disturb it, he should seek for means of counterbalancing the mischief. In the case of insect depredations, while more immediate remedies may be necessary at first, there is little room for doubt that the protection and encouragement of insectivorous birds offer, in most cases, the surest means of relief.

NECESSITY OF MAN'S WARFARE UPON DESTRUCTIVE SPECIES.

The objection that birds destroy useful and harmful insects indiscriminately also applies to most modern insecticides. Spraying the trees for scales destroys the beetles which may be feeding upon the scales. When caterpillars are killed, either by spraying or by any other wholesale method, the larvæ of parasitic Hymenoptera which they contain are destroyed also.

The eminent French entomologist, Paul Marchal, writing upon this point, says:

> Some authors, struck with the eminently useful rôle played by parasites in some invasions of insects, have gone so far as to advise the cessation of destructive measures in the fear of killing at the same time the parasites which they harbor or the predaceous insects which prey upon them * * *. In the great majority of cases, on the contrary, it may be said that however useful the parasites may be, the fear of destroying them ought never to prevent the taking of all measures having for their object the direct destruction of harmful insects * * *. An intervention by destructive methods, far from being dangerous, would permit us, on the contrary, always to obtain a double result; first, it will immediately stop the damage and save the products of that year in a more or less complete manner, and second, it is not likely that in the great majority of cases the caterpillars will be more abundantly parasitized in that particular spot than in any other portion of the country. So that in destroying a certain number of nonparasitized caterpillars one will diminish for the whole region a number of possible adults, which would insure the generation of the following year, and that without changing the existing proportions between the parasites and the representatives of the injurious species.[a]

There is probably no way of destroying insects on a large scale not open to the objection that it is liable to kill friends as well as foes. And it should be remembered also that nature destroys indiscriminately, and, as we have endeavored to show, thus produces in the long run the greatest good to the greatest number. Marchal has also taken the same view of the relation of insectivorous birds to insects that he has of the relation of parasitic and predatory insects to harmful ones. He says:

> The assertion that insectivorous birds can cause more harm than good by attacking either the useful species or the larvæ parasitized by them does not appear to us well founded, and seems to us to be refuted by analogous argu-

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[a]Annales de l'Institut National Agronomique, 2ᵉ Serie, Tome VI, Fascicule 2ᵉ, pp. 298–299, Paris, 1907.

ment. In spite of the theory formerly proposed by Perris and ably defended of recent days by Berlese and Severin, the protection of insectivorous birds appears to us not at all susceptible of thwarting the beneficial action of useful insects.[a]

CONCLUSION.

That birds do little or no harm by eating insects indiscriminately may perhaps be better shown by an illustration. Let us suppose that half of all of the individuals of every species of insect in the world were suddenly destroyed; half of the cotton boll weevils, half of the Colorado potato beetles, half of the chinch bugs, half of the codling moths, half of the innumerable host of other pests to the farmer and fruit raiser, and also half of the vast multitude of predatory and parasitic species swept away at one fell swoop. Is there any farmer or horticulturist who would not welcome such destruction? Would it not be a blessing to vegetation as far as cultivated crops are concerned? Many insects that are now troublesome would by this reduction be rendered comparatively innocuous, while in other cases the farmer would be able to cope successfully with the remainder. Now, this reduction would leave entirely undisturbed the internal relations of the insects themselves. The predatory beetles remaining would have proportionally just as many scales or larvæ to feed upon as before. The parasitic Hymenoptera would have just as many hosts to infest and the scales and larvæ would have just as many enemies to prey upon them. That a great increase of vegetation would take place is probable, but this would very soon be counterbalanced by the unusual supply of food offered to rodents and other herbivorous mammals, and in fact in a short time the insects themselves would, through the increased facilities for multiplication, resume their normal numbers unless there arose some other factor to hold them in check, such, for instance, as a great increase in the number of birds.

In closing the writer can not do better than again quote Professor Forbes:

> To avoid or mitigate the evils likely to arise and to adapt the life of his region more exactly to his purposes, man must study the natural order as a whole and must understand the disturbances to which it has been subject. Especially he must know the forces which tend to the reduction of these disturbances and those which tend to perpetuate or aggravate them in order that he may reenforce the first and weaken or divert the second.
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> The main lesson of conduct taught us by these facts and reasoning is that of conservative action and exhaustive inquiry. Reasoning unwarranted by facts and facts not correctly and sufficiently reasoned out are equally worthless and dangerous for practical use.

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[a] Annales de l'Institut National Agronomique, 2e Serie, Tome VI, Fascicule 2e, pp. 298–299, Paris, 1907.

TYPES OF FARMING IN THE UNITED STATES.

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At no previous period in the history of America have city people evinced so much interest in farming as at the present time. Large numbers of city toilers are looking longingly to the country as an avenue of escape from the uncertainties of city employment. At the present time there is practically no literature that will give these people, unacquainted with even the rudiments of farming, a general view of the possibilities of farm life. To meet the needs of persons of this class the various types of farming to be found in this country are outlined in this paper. In addition some discussion is given of the factors which determine the type of farming under given conditions.

Students of farm management in the colleges and high schools will also find this outline advantageous in giving them some idea of types of farming with which they are not acquainted, the conditions determining these types, and the distribution of the types in the United States.

BASES OF CLASSIFICATION.

Types of farming may be classified on several different bases.

RELATION TO MAINTENANCE OF FERTILITY.

Those types of farming which make no provision for maintaining or building up the fertility of the soil are called exploitive types. They exploit the soil. Exploitive farming is characteristic of regions in which farming is new. Nature has spent ages in excavating the soil by means of plant roots and filling the soil with decaying organic matter. Insects have made their burrows deep into the soil and thus opened it up for the circulation of air and water. When first put into cultivation most soils are rich and can be farmed for many years without attention to fertility. Such farming is usually quite profitable as long as the fertility of the soil lasts. History shows that exploitive farming may continue without serious consequences on

rich soils for twenty to fifty years, depending on the character of the soil and the climate; the farther south one goes the quicker the humus (decaying organic matter) rots out of the soil.

Generally speaking, after exploitive farming has reduced the fertility of the soil to the point where paying crops are no longer produced, types of farming are introduced which build up the soil and make it fertile again. Usually these conservative types of farming produce forage for live stock and put the manure back on the land. There is some evidence that the soil may be brought back by growing green crops, especially certain leguminous crops—cowpeas, crimson clover, vetch, bur clover, and the like—and turning them under. Where it is possible to grow forage crops only and to buy grain or other concentrated feed at a reasonable price, good strong land may be built up and made highly fertile without the use of chemical fertilizers; but generally, in those sections of the country where farming has been followed for more than half a century, commercial fertilizers are used to a greater or less extent.

There are some instances where exploitive types of farming have remained after the soil has been very greatly exhausted, resulting in more or less abject poverty on the part of those who till the soil. The most striking instance of this kind is on the small cotton farms of the South, on most of which no effort is made to keep a supply of humus in the soil, cotton being grown year after year, chemical fertilizers being relied upon to keep up the land. The production of corn and wheat in southern Missouri, of wheat in southern Illinois, and of hay in New England are other examples of exploitive types of farming that have continued beyond their legitimate life.

INTENSITY OF OPERATION.

Farming is said to be extensive or intensive according to the amount of capital and labor used upon a given area. On the grain fields of the West one man farms a large area. The amount of work done per acre is small and the income per acre is usually comparatively small. Extensive farming is usually exploitive, though not always so. It is more or less characteristic of newly settled regions. Almost any system of farming may be carried on in an intensive way. The farmer who grows 100 bushels of corn, 40 bushels of wheat, or 3 tons of hay per acre is doing intensive farming. Ordinarily, however, the term "intensive farming" applies to such types as truck and fruit growing, poultry raising, etc., where a large amount of capital and a large amount of labor are used per acre. As a general rule, the more intensive the type the larger the income from a given area of land.

DIVERSITY OF CROPS OR INDUSTRIES ON THE FARM.

We frequently hear such terms as "single-crop" farming and "diversified" or "mixed" farming. The most striking instances of single-crop farming in this country are to be found in the cotton plantations of the South, the grain farms of the Plains region and parts of the Pacific coast, the rice-growing areas along the Atlantic and Gulf coasts, the tobacco-growing sections in the Atlantic States, and the cornfields on many farms in the Middle West. The term does not mean to imply that only one crop is grown, but one crop brings in practically the whole income of the farm family. Such types of farming are nearly always exploitive and usually extensive. In diversified or mixed farming there are several sources of income, usually several crops are grown, and frequently live stock is kept in addition to the animals needed to work the farm. As a rule, farms are more or less diversified in their industries, and it is usual to find two or more types of farming carried on together on the same farm.

In the outline which follows, it is not to be understood that these numerous types of farming exist distinct from each other on different farms except in cases where it is so stated. Most successful farms combine two or more types.

SOURCES OF INCOME.

The source of income is the usual basis for classifying the types of farming. For instance, when we speak of a hog and seed-corn farm, we mean one on which the principal sources of income are hogs and seed corn. According to sources of income we may divide types of farming into crop farms, mixed stock and crop farms, live stock farms, and miscellaneous farms, with various subdivisions of each of these classes.

CLASSIFICATION BASED ON SOURCE OF INCOME.

Crop Growing.

Those types of farming in which the principal income is from crops sold may be divided into (1) truck farming, (2) fruit growing, (3) single-crop systems, (4) dominant-crop systems, and (5) a miscellaneous group for which there is no appropriate name and described here as "other crop systems."

TRUCK FARMING.

The production of garden vegetables, commonly called truck farming, is one of the most intensive types of farming, and requires a comparatively high capitalization as well as a large amount of labor.

At the same time, where markets are good, the income is so large that a family can make a living on a very small area of land. In fact, 10 acres would be a large truck farm, and 2 or 3 acres properly managed, with good markets, will bring a fair living to an ordinary family. There is abundant literature about the cultivation of the various truck crops, and this type of farming is a desirable one for beginners, although a great deal of study and some experience are necessary before success can be attained. Truck farming assumes three phases: First, every farm should have a garden which produces such vegetables and small fruits as are needed for home use. Second, in the vicinity of every city, town, and village there is room for a small number of truck farmers who can supply local markets. This is a much safer form of trucking than the one mentioned later, and is, generally speaking, to be recommended. The crops to be grown must be determined by climate, soil, and market demand. The third system of trucking, which is widely developed along the Atlantic seaboard and is found to some extent in other sections, is that of growing vegetables for shipment to distant markets. This type of trucking requires not only a large capital and great expense, but it also requires a large amount of reserve capital on account of the great fluctuations in receipts for products shipped. Some years enormous incomes are obtained per acre; other years there is a dead loss. The business is very uncertain and is not recommended to beginners.

FRUIT GROWING.

There are so many types of fruit growing that they can not be appropriately discussed within the space available for this article. What has been stated concerning truck farming may be said in a general way concerning the production of berries and of small fruits. Where there is a local market, these fruits may be quite profitable; but, when one must depend upon shipping to the large cities, the results are very uncertain. The production of winter apples for shipment to the large markets has proved in the main a profitable industry. Generally speaking, the production of any kind of fruit for market, especially tree fruits, necessitates waiting several years before any income is obtained, and it is usual to combine truck farming with orchard growing, gradually abandoning truck crops as the fruit comes into bearing. There is much good literature to be had about practically all phases of fruit growing. The beginner is especially warned against embarking his capital and time in new ventures in the line of fruit growing. It is better to stick to those things which have demonstrated themselves to be successful.

SINGLE-CROP SYSTEMS.

The principal crops found on single-crop farms in the United States are cotton, wheat, corn, hay, tobacco, rice, sugar cane, and hops. Other crops are grown as practically the only crop in small areas in various parts of the country. Generally speaking, the equipment required for conducting a single-crop farm is less than for any other type of farming. On the ordinary one-horse cotton farm of the South the cost of buildings, work stock, and farm implements will average about $8 per acre; on the exclusive grain farm with a moderate equipment the cost is about $20 per acre; with corn as a principal crop the cost is about the same; on an exclusive well-equipped hay farm, the cost of equipment, including buildings and fences, is approximately $40 per acre; on farms where tobacco, rice, sugar cane, or hops are grown the cost is considerably more.

Cotton farming is confined to our Southern States, extending into southeastern Virginia, all of North Carolina except the western portion, south-central and western Tennessee, southeastern Missouri, central Oklahoma, and west into western Texas. A small quantity of cotton is grown in New Mexico and Arizona. An average family, with one horse, can cultivate about 20 acres of cotton and 10 acres of corn. The average yield of cotton is two-fifths of a bale, or 200 pounds of lint cotton, worth, say, $20. Twenty acres of this crop would therefore produce an income of $400. On tenant farms, where the tenant furnishes the labor, the custom is for the tenant to take half the crop and to pay half the fertilizer bill, making the income of the family about $175 per annum. This is for average conditions. By growing winter cover crops and by this means supplying the soil with humus, this income may easily be doubled.

Exclusive wheat farming was formerly practiced over wide areas, but this system of farming has exhausted the soil in regions where it has prevailed for half a century to such an extent that, with one or two exceptions, the system has been replaced by better ones. As it will undoubtedly be replaced in the near future in all regions where it now prevails, except possibly the semiarid Plains regions, it is not necessary to dwell further upon this type of farming. It is found in the upper Columbia basin of Oregon, Washington, and Idaho, in the Sacramento Valley of California, in the Dakotas, and in the semiarid Plains regions. Wheat growing is not the exclusive type of farming in these sections, but it is the prevailing type.

Exclusive corn growing is confined to individual farms scattered throughout the Middle West. It is also found in the hill country of the South to some extent. Farmers who follow this type of farming are usually poor and are getting poorer.

Exclusive hay growing is also found on individual farms in many parts of the country—east, west, north, and south—but is hardly the prevailing type of farming in any large section. It occurs on a good many farms in New England, on some alfalfa farms in the West, occasionally on a farm in the Middle West in the midst of the corn belt, and on an occasional farm in the South. When proper attention is given to fertilizing the land, hay farming is a legitimate industry. The ordinary crops grown for hay provide a fair amount of humus and their roots penetrate the soil in such a way as to keep it fairly open. By the use of commercial fertilizers it is possible to maintain the yield on a hay farm for a long period of time. For the past few years the price of hay has been fairly remunerative and hay farming has been profitable.

At the present time one of the best opportunities for those entering upon farming is hay growing in the South. In that section comparatively little hay is produced for the market and a good deal is shipped in from the North. There are many crops which may be grown very successfully for hay in the South, and there should be a large development of this type of farming in the next few years. The reader is especially referred to Farmers' Bulletin No. 312, entitled "A Successful Southern Hay Farm," as an indication of the possibilities of this type of farming in the South. The results secured could hardly be duplicated under average conditions, but even half the profit obtained by this farmer would justify one in undertaking the business.

Exclusive tobacco growing is found in Connecticut, parts of Maryland and Virginia, and in one locality in northern Florida and southern Georgia. When proper attention is given to keeping up a supply of humus in the soil, fair yields of tobacco are obtained. One man can cultivate about 5 acres of this crop. It is estimated that it costs about 8 cents a pound to grow tobacco when the average yield is 700 pounds per acre. By proper management 1,000 pounds per acre may easily be produced, and in some sections much more than this is grown. Generally, however, tobacco growing does not offer an inviting opportunity to those entering upon farming for the first time.

Along the Atlantic coast there are certain lands which at high tide are covered by fresh water from the adjacent rivers, but which at low tide are above water. Large areas of these lands have been reclaimed by diking and are devoted to rice growing, no other crop being grown upon them as a rule. In this section it is estimated that it costs about 70 cents a bushel to grow rice, a large part of the expense being for keeping up the dikes. These dikes are frequently broken by storms while growing crops are on the land and involve great expense in their repair. The price of rice for the last few years has made the rice industry on the Atlantic coast a precarious one. The largest rice-growing region in this country is found in southern Louisiana

and the Gulf coast of Texas. In this region irrigation of the rice fields is accomplished in a different manner from that on the Atlantic coast, namely, by canals taking water from rivers or from artesian wells. Rice is produced more cheaply, but the price of rice in recent years has checked the development of the industry. At the present time it is developing slowly and more conservatively than was the case a few years ago, and while the business is a fairly good one it should not be entered upon without due consideration.

Sugar cane, for the production of cane sugar and cane sirup, is grown more or less in all the Gulf Coast States. By far the largest production of this crop is in southern Louisiana, but a good deal is grown in adjacent parts of Texas. In other sections the crop is grown only for sirup making. On plantations where sugar cane is grown for sugar, enormous capital is required for successful operation, as the crop must be produced on a large scale.

Hops are grown principally in one or two counties in New York, in central and western Washington, western Oregon, and California. The areas grown are usually small. The income from the hop crop is perhaps the most variable of all crop incomes in America because of wide fluctuations in the price of dried hops. Exclusive hop growing is an exceedingly risky enterprise. It is far safer to grow a few acres on a farm devoted mainly to other crops, so that if there is a loss there may be other resources to tide over the period of low prices.

DOMINANT CROP SYSTEMS.

In several sections of the United States there is a rotation of crops containing one crop which is the principal source of the farmer's income. Tobacco is grown in this manner in parts of Kentucky, Ohio, and Tennessee, and to a slight extent in other tobacco-growing sections. The rotations in which tobacco is grown are so variable that it is thought unnecessary to enter upon a discussion of them here.

In Aroostook County, Me., the prevailing type of farming is one in which the rotation covers a period of three years, the crops being (1) potatoes, (2) oats, and (3) clover. The land is usually divided into three approximately equal areas, so that each of these crops is grown every year. In some parts of Pennsylvania and Ohio a similar rotation is found in which wheat is substituted for oats. This is known as the Terry rotation, for the reason that it has been widely advocated by Mr. T. B. Terry, a well-known writer and farmers' institute worker.

In certain sections of the West, sugar beets are grown as the dominant crop in the rotation. In the alfalfa regions of the West the rotation generally consists of two or more years of alfalfa, fol-

lowed by one year of potatoes or grain in order that the alfalfa roots may become decomposed, and then one or two years of sugar beets, followed by grain with which alfalfa is sown. The rotations used on sugar-beet farms in Nebraska, Michigan, and eastward are highly variable.

These types of farming in which one crop in the rotation is the principal source of income are very satisfactory, especially where the remaining crops are fed to live stock and the manure is put back on the land. Most of them require considerable capital for equipment, and require considerable labor compared with the single-crop systems previously outlined, but they are fairly remunerative, and in some instances exceedingly so.

Cotton occupies the position of a dominant crop on a few farms in the South in one of the best crop rotations to be found in this country. The rotation consists of cotton, followed by corn in which cowpeas are sown at the last cultivation, the next crop being winter oats, followed by cowpeas the succeeding summer. This rotation gives two opportunities for winter cover crops to be turned under to supply humus, namely, between cotton and corn and between cowpeas and cotton. Crops available for use as winter cover crops in this rotation are rye, oats, bur clover, crimson clover, common red clover, hairy vetch, and common vetch. This rotation builds up the land very rapidly, the yield of cotton going up more rapidly than that of the other crops. Many farmers, following this rotation and using a moderate quantity of commercial fertilizer, secure a bale to a bale and a half of cotton per acre. Such farming is quite profitable and is to be recommended generally for the Southern States. Even where the winter cover crops are omitted the system is a fairly good one.

OTHER CROP SYSTEMS.

Scattered here and there over the country are farms devoted to the raising of seeds for sale. These farms are of two classes, namely, those which raise vegetable seeds, usually on contract for some large dealer, and those which make a specialty of growing improved seeds of ordinary field crops. The latter class of farming, that is, the growing of improved seeds of corn, cotton, potatoes, wheat, oats, etc., offers at the present time one of the best opportunities to be found in farming in this country. The ordinary farmer will not take the trouble to breed up the seed of his field crops, yet he will buy improved seeds, and is justified in so doing. The crops which are most easily improved by selection of excellent individuals for seeding are corn, cotton, and potatoes, and there is room for much development in the growing of improved seeds of these crops practically wherever they are grown. Improving the seed of wheat, oats, barley, and

other crops in which the individual plant is small is a very difficult task, and requires technical training for its successful conduct. Such work must be left to the trained specialist. The breeding of improved strains of corn, cotton, and potatoes does not require large equipment, and there is much valuable literature to aid the beginner in this line of endeavor. The growing of seeds of garden vegetables is a specialty which requires a good deal of training and a comparatively large amount of capital and labor. It is not an inviting field for the beginner, yet it is a profitable type of farming when properly conducted.

In many parts of the country rotations of ordinary crops are grown in which no particular crop stands out as preeminent, only such portions of the crops being used on the farm as are necessary to feed the work stock, the remainder being sold. The most common form of rotation on such farms is corn, followed by wheat; this by timothy and clover, which is cut for hay one or two years and then used for pasture for one or more years. Where a large quantity of commercial fertilizers is used, a rotation of this character usually keeps the land in a fairly fertile condition, and a moderate profit is to be obtained. Generally speaking, however, on farms where such a system prevails the land, especially on rented farms, has been exploited with scant attention to its fertility, until there is little profit to be had. It is seldom a desirable type of farming, for even where yields are kept up by the use of commercial fertilizers the expense of the fertilizers eats up a large part of the profits. This system of farming, however, is one which does not require as much technical knowledge as most types of live-stock farming, and for this reason it may be justifiable for a beginner to grow such a rotation for a few years until he has had the experience necessary to succeed with some form of live-stock farming to which the rotation mentioned is fairly well adapted.

Mixed Stock and Crop Farming.

The general type known as mixed stock and crop farming is perhaps the most common type found in the Northern States. It is hoped that it will also ultimately prevail very generally in the Cotton Belt, where the rotation already mentioned in discussing cotton as a dominant crop in a rotation is well suited to this type of farming. In the Northern States the common rotation found on farms of this character is one which has already been described, namely, corn, followed by small grain, and this by timothy and clover for hay and pasture. Many variations of the rotation are found. For instance, corn may be grown two years before seeding the land to wheat or oats. In the northern tier of States oats are usually grown in this rotation in preference to wheat, while in central latitudes wheat usu-

ally replaces oats. In some sections oats follow corn and wheat follows oats. In some localities wheat is grown for two years after corn before seeding down to timothy and clover. In some sections timothy is omitted, clover being sown alone after wheat, or rather sown in the spring on the wheat crop. In a few localities clover is omitted and timothy is grown alone, though in sections where this practice prevails there is usually considerable trouble in keeping up the fertility of the soil. Clover, like all of the legumes, helps to supply the land with nitrogen, the most expensive form of plant food. The legumes secure an abundance of nitrogen from the atmosphere, while other crops must secure their nitrogen from decaying organic matter in the soil.

The live stock found on the largest number of farms of this character in the southern half of the Corn Belt are beef cattle, usually with hogs, while in the northern portion of the section dairy cows are kept. On the better class of mixed stock and crop farms the only crop sold is the small grain. This is especially true in those sections where wheat is grown in the rotation. Where oats are grown it is not unusual for all the crops to be fed on the place. In either case, if the corn and hay are fed to live stock and good use is made of the manure, the fertility of the land is fairly well maintained, though after two or three generations of such farming the use of commercial fertilizers becomes necessary. The equipment on farms of this class, including cost of buildings, fences, implements, live stock, etc., will ordinarily run from $50 to $75 per acre. About one work horse is required for every 25 acres in cultivation, and one laborer for 25 to 40 acres. A family living on a quarter section of land devoted to mixed stock and crop farming, with a fair amount of industry and intelligent management, may be expected to make a good living, and perhaps to lay by a little profit. With the highest type of management a satisfactory profit may be obtained.

In the Southern States where cotton is grown in a rotation consisting of cotton, followed by corn and cowpeas, then oats, followed the next summer by cowpeas for hay or seed, or both, stock farming combines excellently with crop farming. If all the crops except cotton are fed to stock and the manure is intelligently used, large yields of cotton are obtained at comparatively small expense, and the work of the farm is better distributed through the year than on exclusive cotton farms. This is an excellent type of farming in sections where the cattle tick has been eliminated so that cattle can be kept without danger from tick fever. This tick is now gradually being eradicated by the joint efforts of the United States Department of Agriculture and the State authorities, so that an important development of this type of farming is looked for in the future. It is to be highly recommended.

Before passing from this phase of the subject it might be well to mention the use of live stock as adjuncts to sugar factories, canneries, distilleries, etc., which produce large quantities of by-products suitable for feeding to stock. Beef cattle and sheep are usually the stock kept. By feeding these factory products along with a certain amount of grain or other concentrated feed considerable profit has been made. Sometimes dairy cows are fed in this manner with very satisfactory results.

Live-Stock Farming.

The various types of live-stock farming here outlined are usually found on farms which are not devoted exclusively to them, though occasionally a farm is found which sells only live-stock products, especially the better class of dairy farms and many farms where beef cattle are fed.

BEEF CATTLE.

The growing and fattening of beef cattle is an industry found perhaps on a larger number of stock farms than any other. Generally, the profit from this type of farming is small, and a great deal of special knowledge is required to make it profitable at all. It is not a type of farming for a beginner. The most profitable form of beef-cattle raising is the production of pure-bred stock for sale as breeders, but it is only the experienced breeder who has a reputation as a breeder of good stock who can sell young stock at satisfactory prices. Many men embark in the raising of pure-bred beef stock, paying high prices for their foundation stock, and then fail because the lack of a reputation makes it impossible for them to sell their young stock at a satisfactory price.

A great many men raise beef cattle for sale as feeders. A large proportion of these cattle are raised on the ranges of the West. Ranging cattle was formerly a very profitable business, but the best ranges have now been turned into farms, and on the poorest ranges sheep are gradually replacing beef cattle, so that the range-cattle industry of the West is not so satisfactory as some years ago. A good many farmers who follow a mixed system of stock and crop farming keep a few cows of the beef breeds and raise the young for sale as feeders. This type of beef-cattle farming is perhaps the least profitable of all.

Fattening steers for market is one of the leading industries of the Middle West. On some farms steers are bought in the spring and grazed during the summer, the best of them being sold for meat before winter comes on, the others being sold as winter feeders. Some farmers who make a business of fattening steers buy their steers in the fall and fatten them during the winter. Others combine summer grazing and winter feeding. Usually the farmer who makes a busi-

ness of feeding steers does not expect to make much profit directly from his feeding operations. He justifies his course, however, by the fact that through this disposition of his crops he secures a fair price for his grain and hay and retains the manure on his farm, thus keeping up the fertility of his land. It is customary to keep a few hogs on farms where the winter feeding of steers is practiced, in order that the hogs may consume the waste grain in the droppings from the cattle. When hogs and cattle are thus combined there is usually some profit in the feeding operations.

A few farmers keep cows of the beef breeds and force the young stock by heavy feeding, selling it early as "baby beef." Beef of this character sells at the highest price, but is expensive to produce. The profit from it is not great, yet this type of farming serves to maintain the fertility of the land and returns a fair price for the crops consumed.

SHEEP.

There are four types of sheep farming: (1) The raising of stock for sale as breeders, which is perhaps the most profitable form of sheep raising on the ordinary farm. (2) The raising of sheep for wool and mutton—a type found both on farms and on the ranges of the West. Usually the range man clips the wool and sells his young stock to farmers of the Middle West to be fattened during the winter. (3) Early winter lambs. Some sheep raisers have the lambs produced very early in the season and send them to market late in winter, at which time they sell for very high prices. Frequently these lambs when in proper condition will sell for much more than they would bring three or four months or even a year later. (4) Fattening sheep for market. This industry prevails extensively in the Middle West, where range lambs from the western country are bought and fed during the winter. Extensive feeding operations of this character are conducted in the alfalfa-growing regions of the West, and this type of handling sheep returns a very satisfactory profit to those who understand the business. As is the case with all kinds of live-stock farming, considerable expert knowledge is necessary for a high degree of success.

HOGS.

There are two general types of hog raising, namely, (1) the raising of pure-bred stock for sale as breeders and (2) the production of meat. Most hogs that are raised for meat are sold on foot and sent to the large packing houses. A few farmers cure their own meat, and when they have a good market make a very satisfactory profit from the operation. A still smaller number of farmers butcher their own hogs and sell them as fresh meat, sausage, etc. Hog rais-

ing is perhaps the least difficult of all the types of live-stock farming, and the most profitable considering the amount of labor and capital involved. The equipment for hog raising costs considerable. Including buildings, fences, and live stock, a hog farm requires an expense of about $70 an acre before it is perfectly equipped for the business.

The one great danger in this type of farming is the introduction of cholera in the herd. Cholera is a contagious disease. Frequently it may be kept out by strict quarantine. A few years ago the writer was able to keep his hogs healthy while hogs died from cholera on every adjacent farm. When hogs are sick from this disease their excreta contain the germs of the disease. In walking through an inclosure containing sick hogs, these germs adhere to the shoes and may be carried from one farm to another in this manner. While strict quarantine, when hogs are known to be sick in a community, may not always prevent contagion, it greatly lessens the liability to it.

There is much valuable literature to be had concerning hog management and the various breeds of hogs.

DAIRY CATTLE.

There are three more or less distinct types of dairy farming, namely, (1) the selling of milk and cream, (2) the production of milk for butter and cheese making, and (3) the raising of pure-bred dairy stock for sale as breeders. Generally speaking, when dairy farming is intelligently conducted it is quite profitable, though it requires more labor than other forms of live-stock farming and a larger investment of capital. By beginning in a small way the capital necessary can be earned, and this is usually done by men who embark in dairy farming. In fact, it is much safer to begin any intensive form of farming on a small scale in order to learn the details of the business with as little risk as possible. Dairy farming maintains the fertility of the soil perhaps better than most other types of farming. This is especially true where only the coarser feeds are grown and the concentrates are bought. In recent years the prices of farm labor and concentrated feeds have risen to such an extent as to reduce materially the profit from dairying, but it is still one of the best forms of live-stock farming for the beginner.

By having a good garden and plenty of small fruits, the small dairy farmer has most of his living at home, thus being assured against want. It is best to start in with a good quality of grade cows rather than to begin by purchasing high-priced, registered stock. But it is highly important to use pure-bred sires in building up and

maintaining the efficiency of the herd. Generally it is not safe to depend upon maintaining a herd by buying regularly. It is much more satisfactory to raise the cows on the farm.

As between the various types of dairy farming, local conditions must determine which is most desirable. If one is located near a large city or near a railway station which gives direct connection with a city, the selling of milk or cream is the usual form of dairying followed. In sections where a market for milk is not to be had, butter making is the more usual type of dairying. Even near the large cities a few farmers find it desirable to make butter for supplying private customers, and this form of the industry is a very satisfactory one where the butter can be sold at a reasonable price. Cheese making is not often conducted on the farm, but is usually confined to factories. Most of the butter is also made in factories, and even where milk can not be sent to a city in most regions where dairy farming prevails it can be sold at a local creamery or cheese factory. Concerning the raising of pure-bred dairy stock for sale as breeders the same principles apply as in the raising of other classes of stock. It is only the breeder who has a reputation who can sell his young stock for high prices. Most of these breeders began in a small way, purchasing a few registered cows and gradually allowing their produce to replace the grade cows in their herds.

HORSES AND MULES.

The raising of horses and mules is not generally an exclusive industry on a particular farm. For the most part these animals are raised incidentally in connection with other kinds of farming. A great many farmers keep brood mares with which they do their farm work. It is hardly advisable for the small farmer to engage in this industry, but, where one has an abundance of land and must keep a considerable number of work stock, it is entirely proper to keep a number of brood mares. In some sections of the country, especially in the Middle West, farmers either buy horses in a thin condition and fatten them for sale in the cities as draft horses, or they take horses of this kind to feed at a given price per month. The different types of horse and mule farming are the raising of draft animals, roadsters, saddle horses, ponies, the fattening of thin horses, running horses on the range, and the boarding of city horses. Most of these types of farming should not be undertaken by the beginner, as they require considerable capital and a great deal of knowledge of the industry. Boarding horses is a fairly profitable industry near the large cities.

Poultry Farming.

The raising of poultry is an industry found perhaps on more farms in the United States than any other. Most farmers keep a few chickens which find their living from the waste products of the farm. They are thus practically no expense and all of the product is profit. From 30 to 75 hens can thus be kept on an ordinary farm. The magnitude of this form of the industry is so great that it interferes materially with the special poultry farm. It is probable that more failures are made in poultry farming than in any other type of farming undertaken by beginners, yet it is decidedly one of the best and most profitable types of farming when properly conducted. It is highly essential to begin in a small way in order to learn the details of the business before much capital is invested in it. There is an enormous amount of good literature relating to poultry raising easily available to anyone who wishes to learn the industry.

There are five common types of chicken farming, namely, (1) the production of eggs for the general market, (2) the production of eggs for hatching, (3) the production of broilers, (4) the breeding of fancy poultry, and (5) the hatching of chicks for sale as soon as they are hatched. Nearly all successful poultrymen began in a small way by producing eggs for the general market. By carefully breeding up the flock and developing its egg-laying capacity they have finally been able to embark in the production of eggs for hatching purposes, for which there is a ready sale for men who have earned a reputation for producing good stock. The breeding of fancy poultry is, as a rule, not a very profitable industry. It requires a large amount of special knowledge, and, while a few men have made an eminent success in this branch of the business, a very large proportion of those who have tried it have failed.

The poultry business is a legitimate one in all parts of the country. The market for strictly fresh eggs is practically always good. If the hens are so managed that a large supply of eggs is obtained during the winter, the business may be made highly profitable.

Only a few farms are devoted to ducks, geese, turkeys, or squabs as a more or less specialized industry, but there is an abundance of literature relating to these forms of poultry farming by means of which the beginner may learn the details of the business with a comparatively short experience

Miscellaneous.

There are a few types of farming found occasionally which can not very well be classified in the foregoing outline, and which the beginner should usually avoid. He can, however, make himself familiar with them by means of available literature which can

always be obtained by addressing the United States Department of Agriculture and the various State agricultural experiment stations.

The raising of bees is one of these industries. It is usually combined with fruit raising. The raising of flowers for the city trade is perhaps the most intensive type of farming we have, requiring considerable money for equipment but producing a large income from a given area of land when intelligently conducted. The production of mushrooms is an industry which is conducted in a small way by a considerable number of people. There are a few ostrich farms in Arizona, southern California, and Florida. Fox farming has developed to some extent in the extreme Northern States in the past few years. Not much is known as yet about the management of these animals, but there is a possibility that foxes may become an important source of revenue to a few people in the States bordering on Canada. Farmers' Bulletin No. 328, entitled "Silver Fox Farming," gives an excellent account of the methods used by the most successful growers of foxes and points out the principal difficulties in this type of farming.

CONCLUSION.

It is hoped that the foregoing outline of the types of farming prevailing in this country may be of some assistance to those who are embarking in farming, by way of aiding them in choosing a suitable type. Nearly every type of farming mentioned has its literature in the bulletins of the State agricultural experiment stations and the United States Department of Agriculture and in the many agricultural books and periodicals published in this country. Before undertaking to farm, one should become familiar with the literature of the type of farming chosen. In comparing farming with other industries, the fact should not be overlooked that the intelligent farmer produces a large part of his living on the farm, thus rendering the expense of living in the country much less than in the city. It should be further remembered that the independence of farm life goes far toward balancing its disadvantages when compared with city life; nor should it be forgotten that the farmer requires both experience and at least a rudimentary knowledge of several sciences in order to attain the best success. It is only recently that farming has profited by the discoveries of the scientist, and even yet there is much to learn, especially about the soil. There is growing up, however, a science of farming, and in so far as this science has been reduced to rule, it takes the place of experience to a certain extent. A diligent study of agricultural literature, therefore, may enable the beginner to be successful with comparatively little experience.

SOME THINGS THAT THE GROWER OF CEREAL AND FORAGE CROPS SHOULD KNOW ABOUT INSECTS.

By F. M. Webster,

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ABUNDANCE OF INSECTS.

Insects outnumber all other forms of animal life inhabiting the face of the earth. If the entire insect population of a single acre of arable farm land, in any part of the United States, could be brought together and carefully examined, hundreds of different kinds would be found, some of them doubtless new to the naturalist, the majority new to the farmer, but all either directly or indirectly affecting the financial interests of the latter. Comparatively few of these insects would be found actually to prey upon the grain or grasses over this limited area, the remainder being enemies either of the few destructive species or of each other. But the farmer himself would probably know little regarding the habits of any of them, despite the fact that he may have spent the most of his life in their midst, and sustained greater or less annual loss by reason of their ravages.

LACK OF KNOWLEDGE OF INSECTS AND THEIR HABITS.

The business of farming has made immense strides within the last fifty years, but advancement in a knowledge of insects has not kept pace with this progress. Indeed the modern farmer who plants his grain with a grain drill, harvests it with a self-binder, and thrashes it with a twentieth-century steam thrashing machine probably knows little if any more of these insects than did his grandfather, who a century ago sowed his grain broadcast, reaped it with a hand sickle, and thrashed it with a flail. Inconsistent as it may appear, not one farmer in ten has even a business acquaintance with these insects that may cost him anywhere from 5 per cent to 95 per cent of his crop. This apathy in regard to insects is doubtless due in part to their generally minute forms and obscure habits of life. But much of it is due to the innate propensity of men in general to consider the ravages of insects as insurmountable and incomprehensible phenomena of nature, like storms, floods, or unseasonable frosts, that must be

accepted without question and without recourse. Indeed, in the minds of some they are dictated by a Providence whose acts are final and above question. Precisely a similar opinion relative to smallpox was held by the old Arabian physicians and by medieval schools.

A better knowledge of some of the fundamental principles governing insect life and development than at present prevails would teach the farmer that insect depredations are not to be placed in the same category with floods, storms, and unseasonable frosts, all of which are natural phenomena, not influenced by the acts of man. Ravages of insects, though natural, are in many instances the direct results of man's efforts to bring large areas of country out of a state of nature into a high state of cultivation. To destroy hundreds of kinds of plants, growing over large areas of country, replacing these plants with a selected few and increasing the productiveness of these to the greatest extent possible, is agriculture itself, and though it is practically feeding the civilized world, it is nevertheless directly contrary to the long-established natural order of things.

WHY INSECTS BECOME DESTRUCTIVE.

There is no such thing in nature as a destructive insect. The purpose of insects is, so far as can be determined, to hold plant life in equilibrium, preventing one kind from crowding another out of existence, precisely that which the farmer is, and of necessity, trying his best to do. That this is true is shown by the extreme immunity from insect ravages of newly- or sparsely settled sections of country.

If we select one thousand farmers and their families, scattered over a considerable section of country, we shall find them generally vigorous and healthy, rarely with contagious diseases among them, and these usually confined to a single family. Their dwellings and mode of living may or may not be especially sanitary. If we collect these families together and establish them on a much smaller area, in a city, though we may not have removed them from their particular section of the country, we shall at once have to establish sanitary regulations for their protection from disease. Every farmer knows from his own experience that stock of all kinds thrive better and are less subject to disease if kept in small flocks. Now, the farmer displaces the native, perfectly adjusted flora with his closely allied economic plants, that have been rendered less hardy by long-continued artificial selection and cultivation, which tend to make them even more acceptable to these insects than their coarser and more woody native food plants. Not only this, but owing to his agricultural methods this displacement more often than not occurs just at a season of the year when a supply of food is essential to the life of the insect itself. Thus, over wide expanses of country, he is continually subjecting his grains and grasses to conditions under which

neither he himself nor his domestic animals would best sustain life, and, furthermore, he offers these no protection from their natural enemies, whose province it is to repress just such an abnormal development of a few plants at the expense of the many. In fact, without intending to do so, he invites attack from their insect enemies while offering no protection therefrom.

The advance of the white man across the country from east to west, with the opposition offered by the dusky aborigines, furnishes some of the most interesting pages of American history; but it is the insect problem transferred to a higher sphere of life, and no one has ever thought to liken the Indian outbreak to a hailstorm or to a May or an August frost. The white man killed or drove out the Indian, because he wanted the land on which to grow grain and fodder crops to feed himself, his family, and his domestic animals. The insect attacks these crops because the white man has neither killed nor driven it out, but has taken away its original food plants and given it others which it eats in order to escape starvation. The Indian had little trouble with the insect.

NEGLIGENT FARM METHODS FAVOR DESTRUCTIVE INSECTS.

Farmers have aggravated the situation by leaving uncultivated areas interspersed among their cultivated fields. These areas may be the margins of such fields, along fences or roadsides, or neglected patches, which, on account of their stony soil, or perhaps through other causes, remain uncultivated and neglected year after year. Neglected Osage orange hedges (see Pl. XXX, fig. 1), with the usual equally neglected grass land along either side, form most attractive places for the chinch bug to pass the winter, and in the West destructive outbreaks of this pest have been traced directly to them. In the East outbreaks of the army worm are frequently to be traced directly to the densely grassy roadside, fence row (see Pl. XXXI, fig. 1), or neglected orchard. The writer has seen whole fields of spring-sown oats destroyed by caterpillars of a small moth (*Crambus*) that hatched from eggs deposited in the neglected ground along a fence. In a study of the outbreaks of grasshoppers, made by two assistants, in Washington, Pennsylvania, and New York, during 1908, it was found that these insects invariably originated in neglected patches in cultivated fields or else in the waste lands in the near vicinity of the borders of such fields, and the young fed there until they were able to make their way to the crops (Pl. XXXII). As a rule the farmer seems not to understand that in all of these instances he has the enemy of his crops concentrated in these areas and can fight them there to a greater advantage than he can possibly do after they have become winged and widely spread in his meadows and grain fields, and he

pays no attention whatever to them until after the pests have got beyond control, when he suddenly awakens to the extent of his trouble and writes either to this Department or to his experiment station for instantaneous relief, which can then seldom be afforded him.

SOURCES FROM WHICH DESTRUCTIVE INSECTS HAVE ORIGINATED.

Having shown that the farmer, in his efforts to provide food for the people of his own country, as well as many in foreign lands, has himself brought about the present conditions relative to insect ravages among his crops, it will now be necessary to point out some contributing factors before taking up the question of the kinds of insects involved. It so happens that, Indian corn excepted, all of our cereals and cultivated forage plants were, at one time or another in the early days of settlement, introduced from the Old World. It was but natural that the first settlers should bring seeds and grains from their trans-Atlantic homes, and that they should bring also hay and straw as packing for their domestic utensils.

In the seeds and grains have been brought also a number of destructive insects infesting them, which have thrived and spread over the country, many of them attacking not only the seeds and grain in store, but also the grain fields to which they have escaped before harvest. With the straw or grass packing have come also a number of species of very destructive insects, and these, too, have escaped to the fields and spread out over the country, attacking and destroying cereal and forage crops, becoming as bad as in their native country, or even worse. Thus it is that the farmer has at present two kinds of insect pests with which to deal: One class composed of native insects forced to change their food from the native to the introduced grass plants and grasses, and the other class composed of insects introduced accidentally with these plants in some form or other and in or with articles of international commerce.

To these two classes the farmer may assign the insect pests of his crops; and, as has been shown, both have arisen from acts of his own or of his ancestors. For the enormous increase in numbers of these insects, he has only to thank his efforts to increase the acreage of the food plants that he annually provides for them, without, at the same time, putting forth any efforts to counteract the increase of the insects.

The prime causes that result in insect depredations being such as have been shown, it necessarily follows that the farmer must have some knowledge of the nature of these pests before he can hope to overcome the effect upon them of the advantages that his farming operations have given them. The first thing that he should understand is that the number of insects that actually destroy his crops is comparatively small, while the number engaged in holding them in check is enormous.

FIG. 1.—A ROAD BETWEEN TWO FARMS WITH NEGLECTED HEDGES ON EITHER SIDE, AFFORDING AMPLE PROTECTION FOR DESTRUCTIVE INSECTS DURING WINTER.

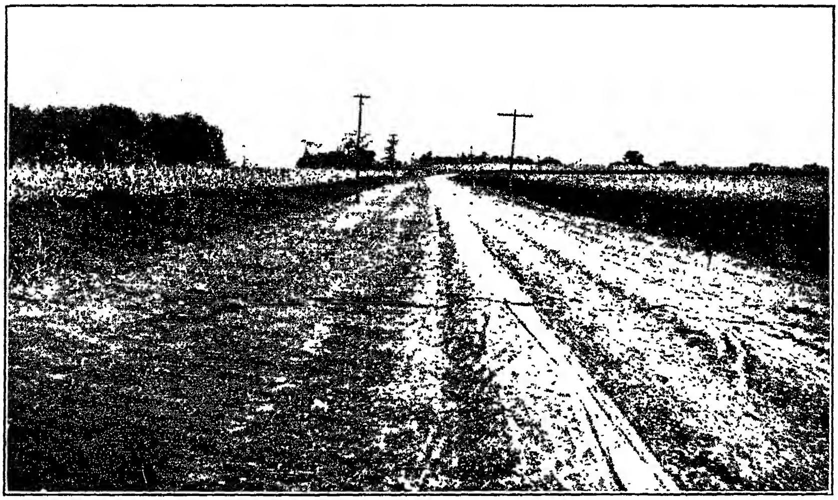

FIG. 2.—ROAD WITH WELL-KEPT HEDGES ON EITHER SIDE, ALL VEGETATION BETWEEN CLOSELY MOWN OR PASTURED.

[This affords the least possible protection for destructive insects during winter.]

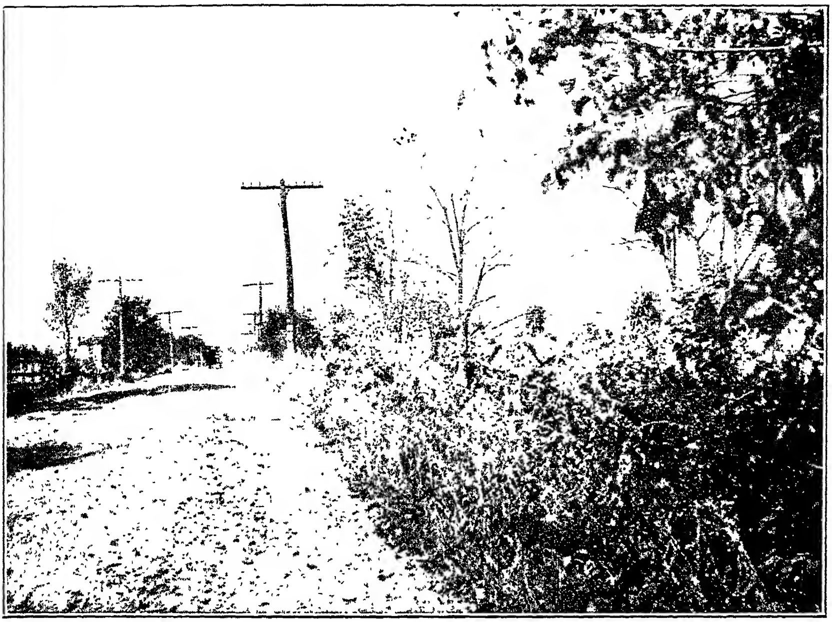

FIG. 1.—POORLY KEPT ROADSIDE WITH RAIL FENCE OVERGROWN WITH BRAMBLES, THUS AFFORDING PROTECTION FOR LARGE NUMBERS OF DESTRUCTIVE INSECTS DURING WINTER.

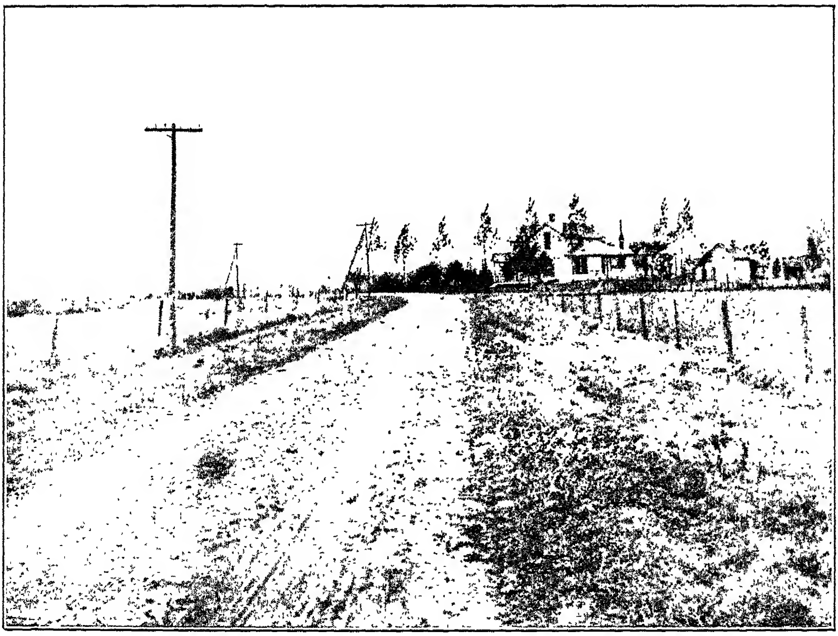

FIG. 2.—A WELL-KEPT ROADSIDE, OFFERING THE LEAST PROTECTION POSSIBLE FOR DESTRUCTIVE INSECTS.

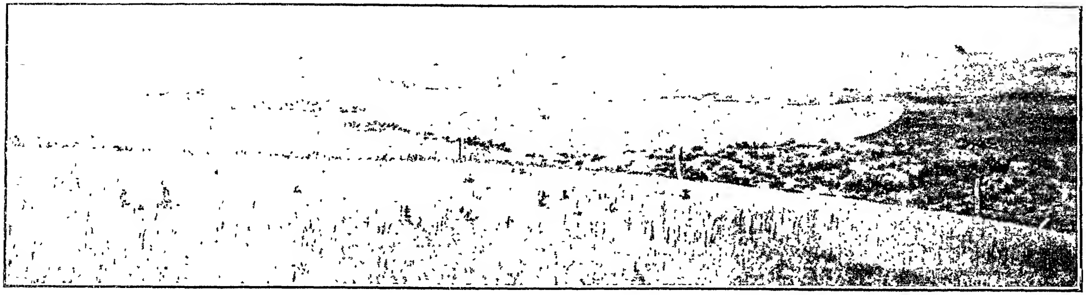

FIG. 1.—WHEAT FIELDS IN EASTERN WASHINGTON, DESTROYED BY GRASSHOPPERS ORIGINATING IN THE ROCKY, NEGLECTED RAVINE LYING BETWEEN THEM.

FIG. 2.—WHEAT FIELD IN EASTERN WASHINGTON, DESTROYED BY GRASSHOPPERS ORIGINATING IN A BORDERING UNCULTIVATED FIELD.

RELATIVELY SMALL PERCENTAGE OF DESTRUCTIVE INSECTS.

Probably not 5 per cent of the different kinds of insects that inhabit a farm are injurious, while many times as many are the farmer's friends, because they are engaged in destroying the pestiferous ones. In fact, the two prime elements in restraining insects are their natural enemies and unfavorable weather. It must be remembered, however, that weather affects both friends and foes. Probably many outbreaks of insects are due not to weather conditions especially favorable to the pests, but rather to those conditions fatal to their natural enemies; relieved of the restraint exercised by their enemies, the species at once develop in myriads and destroy the crops of the farmer.

DESTRUCTIVE INSECTS CLASSED ACCORDING TO METHODS OF FEEDING.

Destructive insects may be divided into two classes, according to the nature of the mouth parts. This is especially important from an economic point of view. The grasshopper, being provided with jaws, can be killed by poisons. The chinch bug, with a sucking mouth, can not be killed by poisoning. The first eats its food, as do the higher animals, while the other sucks the sap from plants, as a mosquito sucks blood, and poison applied to the surface does not go into its food at all. The so-called "green bug" feeds by sucking and consequently can not be killed with poison. If the farmer will watch an insect for a few minutes, to see whether it gnaws its food or sucks the juices, he will learn whether or not he can poison it.

METHODS OF REPRODUCTION AMONG DESTRUCTIVE INSECTS.

Most insects hatch from the egg as larvæ or "worms," having jaws and gnawing their food; but others, like grasshoppers and chinch bugs, hatch out as small "baby" insects which feed and grow to their full natural size. In the case of those young which are wormlike and hatch from the egg, the worms feed and grow in size, and when they change to the fully developed insect they are as large as they can become. Indeed, in many cases all of the feeding is done in the worm stage. Thus, the Hessian fly (fig. 3) itself is not known to feed at all. The army-worm moth (fig. 4) is as big when it comes from the chrysalis as it will ever be, and the only food it can possibly take is the nectar from flowers, and it is not known to take even that. So, then, in case of cutworms, army worms, the Hessian fly, joint-worms, and many others, the adult insect is harmless. In fact, many of them do not feed at all, the feeding and growing period being confined wholly to the larval or worm stage of development. The male insects die soon after pairing, and the females as soon as they have deposited

their quota of eggs. Insects do not survive through a series of years and lay eggs year after year, as fowls and other birds do, but when their single supply of eggs is exhausted they die. The egg-laying period may be prolonged, however, covering many days, or even a month. With the so-called "green bug," *Toxoptera graminum* (fig. 5), and other aphides reproduction is carried on in two ways. The young hatching from over-wintering eggs in spring are, all of them, females, and when they become full-grown, in about a week, they give birth to their young, which are also all females; and this goes on generation after generation until late summer or fall, when some of the young that are born grow up females and others males, but the female produces eggs instead of young. Occasionally she will do both, first giving birth to several young and then depositing eggs. Precisely as with exclusively egg-laying insects, they produce but a single generation and then perish. The time required to produce their young may be prolonged, but once their single supply has become exhausted they soon die.

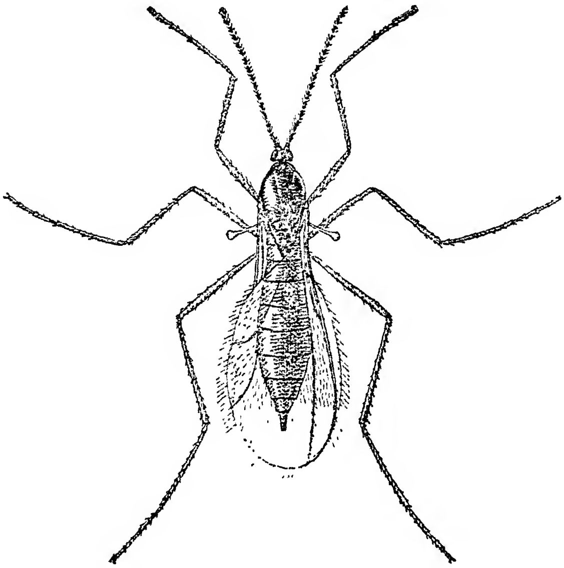

FIG. 3.—The Hessian fly (*Mayetiola destructor*): Adult female. Much enlarged. (Author's illustration.)

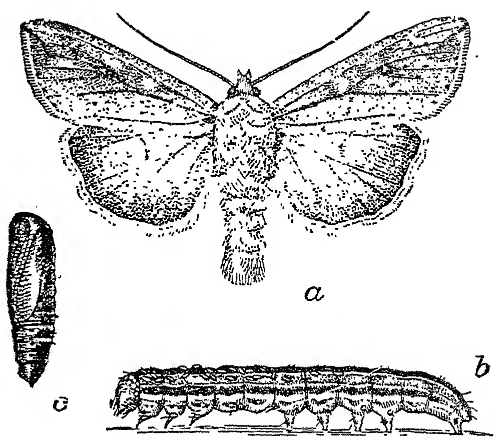

FIG. 4.—Army worm (*Heliophila unipuncta*): *a*, Adult moth or miller; *b*, larva or army worm, with eggs of tachinid parasite on back; *c*, pupa. Slightly enlarged. (Author's illustration.)

This double method of reproducing among insects is not common, however, and the farmer is not likely to have to deal

with it except in cases of the "green bug" and "lice" on the roots of corn.

THE TIME OF OVIPOSITION AMONG DESTRUCTIVE INSECTS.

In the case of many insects with which the farmer has to deal, the eggs are deposited in spring or early summer, but the life history of the different kinds starting thus may differ greatly. In the case of the Hessian fly the eggs hatch within a week, and there is more than a single generation before winter, which is passed in an almost fully developed stage, only a few warm days in spring being required to bring out the flies. In the case of the white grub, or "grubworm," the eggs are deposited in June in the northern parts of the country, hatching in about a month, but it is generally believed that the fully

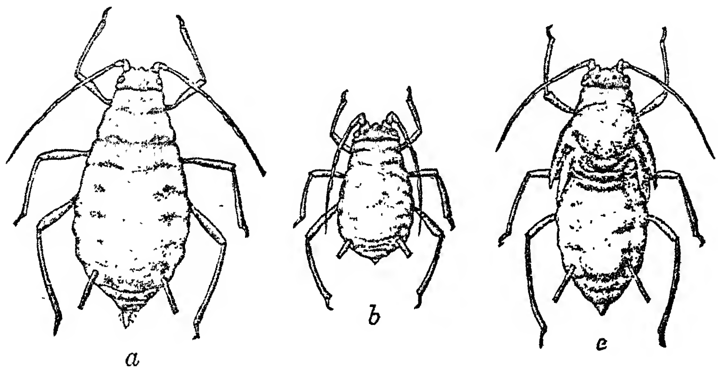

FIG. 5.—The spring grain-aphis or "green bug" (*Toxoptera graminum*) : *a*, Wingless female; *b*, larva; *c*, pupa. Much enlarged. (From Pergande.)

developed insect does not appear until two years from the following spring. The development of the wireworm is practically the same. With the clover-leaf weevil (fig. 6), eggs are laid about the same time as those of the Hessian fly, but there is only a single generation, and the insect passes fully three-fourths of the year as an adult. With the western corn root-worm, *Diabrotica longicornis* (fig. 7), the eggs are laid during September and possibly early October, but they do not hatch until the following May. In the case of the southern corn root-worm, *D. 12-punctata* (fig. 8), the fully developed insect passes the winter and deposits its eggs in early spring, but the young from these develop to adults, so that there is another generation during summer. It is essential that the farmer understand these facts, else he is likely to apply repressive measures at the wrong season of the year or, indeed, after the insect has done its destructive work and escaped. From July to the following June, the time when the female

deposits her eggs, the wheat joint-worm, *Isosoma tritici* (fig. 9), is a small, helpless worm, generally in the stubble left in the fields at harvest. In other words, for more than ten months of the year it is at the mercy of the farmer, and he, knowing this, is in a better position than anyone else can possibly be for devising practical means of destroying the pest before it has matured and flown away to other fields.

INSECTS HIBERNATING ABOVE GROUND.

Insects hibernate or pass the winter either above ground as adults, young, or eggs, or below ground as eggs or in the process of development. If they overwinter above ground as adults they usually

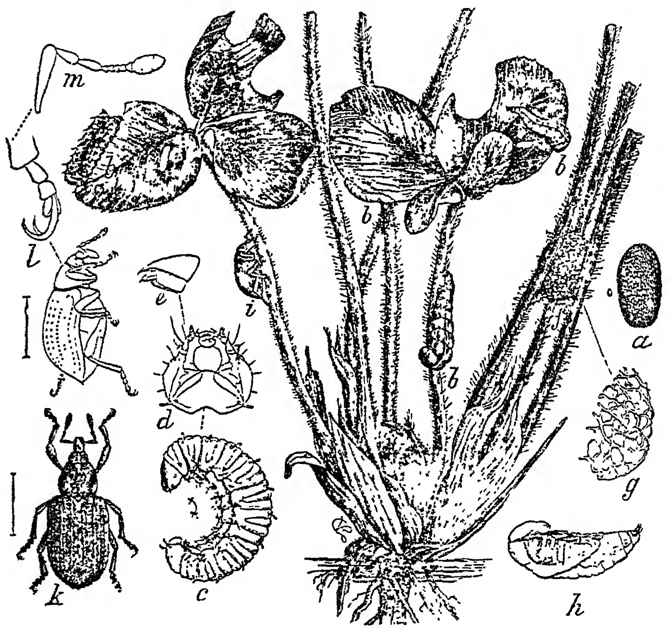

FIG. 6.—The clover-leaf weevil (*Phytonomus punctatus*) : *a*, Egg ; *b*, *b*, *b*, *b*, larvæ feeding ; *c*, recently hatched larva ; *d*, head of same from beneath ; *e*, jaw of same ; *f*, cocoon ; *g*, meshes of cocoon ; *h*, pupa ; *i*, beetle ; *j*, same, in outline ; *k*, same, dorsal view ; *l*, tarsus of beetle ; *m*, antenna of same. Only *b*, *f*, *i*, natural size ; others more or less enlarged. (From Riley.)

seek out, in the fall, grounds covered with matted grass or fallen leaves, brush piles or similar places, shocks of corn fodder left standing in the fields, old straw or hay stacks, and the overgrown waste lands along rail and hedge fences. (See Pl. XXXI, fig. 1.) If in the worm or larval stage, their wintering place is more often within the stems of the plants they destroy or injure. The writer has traced a disastrous outbreak of the chinch bug in wheat to neglected patches of woodland lying adjacent, and less destructive outbreaks, also in wheat, to bugs hibernating in outstanding shocks of corn fodder.

Attention has already been called to the danger likely to result from chinch bugs wintering over among the fallen leaves and matted grass along Osage orange hedges on the western prairies, where there are no woodlands to offer protection. The clover-seed chalcis, *Bruchophagus funebris* (fig. 10), a very destructive enemy of both clover and alfalfa seed, winters over in the heads of both plants growing along roadsides and along fences. Neither of these pests, which cost the farmer in some instances the greater part of his seed crop, could breed if these places were burned over or grazed off in summer and fall. The clover-flower midge, *Dasyneura leguminicola*, also breeds in the heads and winters in the matted grass and rubbish on the ground, but this pest can not breed in these places if clover is not allowed to grow there in summer and fall. (See Pl. XXX, fig. 2; Pl. XXXI, fig. 2.) The timothy joint-worm breeds in the stems of this grass growing on these waste lands, winters over in the stems, and the full-grown insects escape to the field and deposit their eggs the following summer.

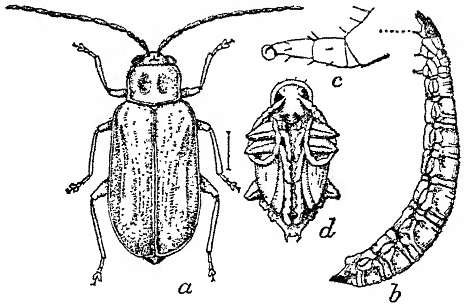

FIG. 7.—Western corn root-worm (*Diabrotica longicornis*) : *a*, Beetle; *b*, larva or root-worm; *c*, enlarged leg of same; *d*, pupa. All enlarged; *c*, more enlarged. (From Chittenden.)

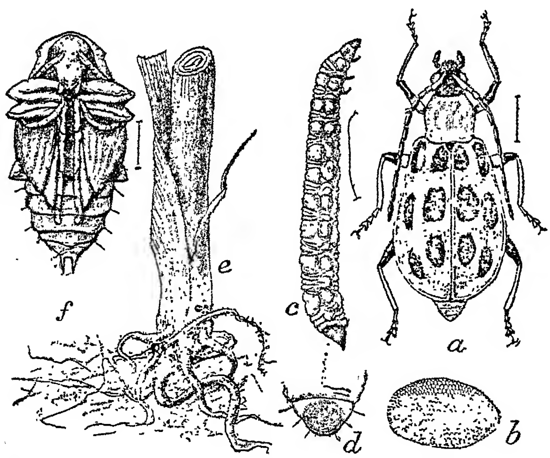

FIG. 8.—Southern corn root-worm (*Diabrotica 12-punctata*) : *a*, Beetle; *b*, egg; *c*, larva; *d*, anal segment of larva; *e*, work of larva at base of cornstalk; *f*, pupa. All much enlarged except *e*, which is reduced. (Re-engraved after Riley, except *f*, after Chittenden.)

FENCES AS PROTECTION FOR INSECTS.

Of all forms of fence the zigzag rail fence (Pl. XXXI, fig. 1), with the usual growth of brush, brambles, and grass, offers the greatest winter protection for destructive insects. Hedges harbor nearly as many, while a stone wall is almost as bad. The post and woven wire fence (Pl. XXXI, fig. 2) offers the least protection. If these waste places are kept cleaned up the danger will be obviated,

and for keeping down the vegetation thereon there is nothing to compare with a flock of sheep. Given the range of the fields in the fall, they will graze off this protection for insects and return a profit to the farmer. This applies more especially in the East, where the native grasses have given way to bluegrass, which does not burn readily, as it remains green, and can be grazed off in late fall or early winter by horses or cattle. West of the Mississippi River burning over is more practicable than in the East, but both measures are efficient in breaking up these extensive breeding and hibernating grounds for many destructive insects. Burning over in early winter, where this can be done, is almost equally effective in destroying all dead grass stems containing insect larvæ. A well-kept farm has a greater significance from an insect point of view than most people even suspect. What has been stated relative to fences will apply with especial aptness to roadsides, as the writer knows from long years of experience and operation on nearly 2 miles of roadside of his own in the Middle West.

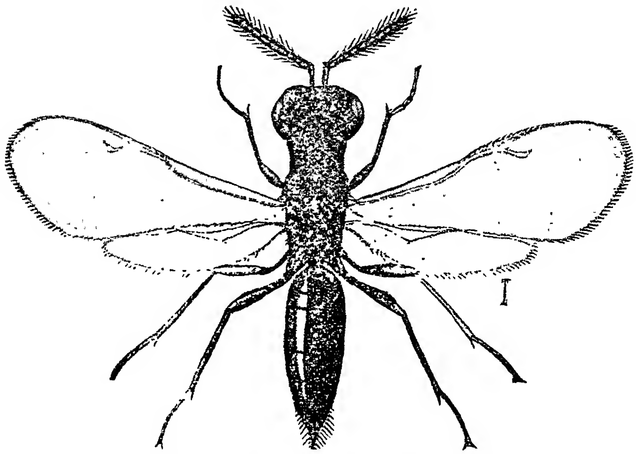

FIG. 9.—*Isosoma tritici*: Adult of the joint-worm. Much enlarged. (From Howard.)

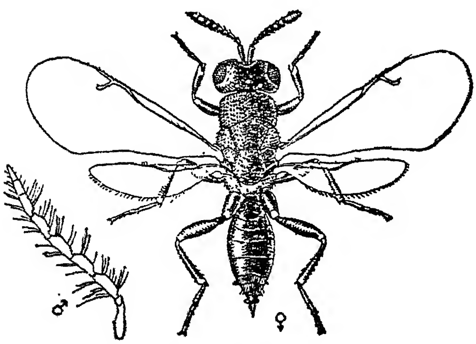

FIG. 10.—The clover-seed chalcis (*Bruchophagus funebris*): Adult female, much enlarged; antenna of the male at left, more enlarged. (Author's illustration.)

INSECTS HIBERNATING BELOW GROUND IN WASTE PLACES.

There are a considerable number of insect pests, and some of the worst ones, too, that winter below ground, and hence no amount of burning over or pasturing the surface will have any effect whatever upon them.

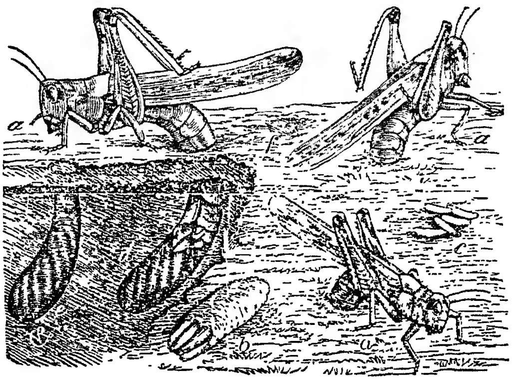

FIG. 11.—Rocky Mountain grasshopper or locust (*Melanoplus spretus*) : *a, a, a,* Females in different positions, ovipositing; *b,* egg pod extracted from ground, with the end broken open; *c,* a few eggs lying loose on the ground; *d, e* show the earth partially removed, to illustrate an egg mass already in place and one being placed; *f* shows where such a mass has been covered up. (After Riley.)

Grasshoppers deposit their eggs in the ground in summer (fig. 11), and these eggs remain in this position until the following summer. Eggs are not placed in the ground in cultivated fields, where cultivation would destroy them, but in the ground that is never molested, such as roadsides, fence rows, rocky knolls, the borders of woods and the sides of open ditches, and from such places the young, as soon as they are large enough to travel, make their way into the adjoining fields of grain, grass, or alfalfa. But the trouble is not always with the grasshoppers. The young of blister beetles

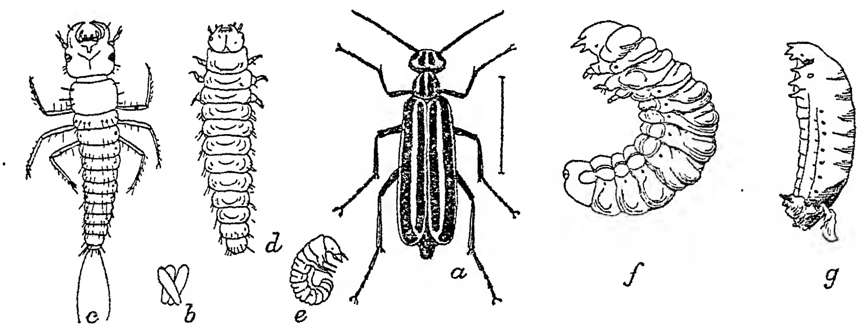

FIG. 12.—Striped blister beetle (*Epicauta vittata*) : *a,* Female beetle; *b,* eggs; *c,* triungulin larva; *d,* second or caraboid stage; *e,* same as *f,* doubled up as in pod; *f,* scarabæoid stage; *g,* coarctate larva. All except *e* enlarged. (*b, g,* After Riley; *a,* from Chittenden.)

(fig. 12) feed on the eggs of grasshoppers in the ground, and we may be reasonably sure of finding these grublike creatures below ground in great numbers where there are grasshopper eggs in excessive abundance. But while the young of the blister beetles may

destroy the eggs and thereby prevent an outbreak of grasshoppers, the beetles themselves are likely to develop here in myriads and descend upon and destroy adjoining fields of either alfalfa or potatoes, until they are almost as great a pest as the grasshoppers themselves would have been. Now, the farmer ought to know these facts and watch these waste lands. If young grasshoppers appear there in abundance they can be disposed of, then and there, by the use of the Criddle mixture or the poisoned bran [a] placed on the ground where the insects can get it, and not only will a grasshopper attack on his adjacent fields be evaded, but also perhaps a later invasion of blister beetles. If he saw a hawk trying to kill his chickens or a dog killing his sheep, probably nothing but poor marksmanship would save either one of these; but usually he allows the still more destructive insects to develop and overrun his fields, at a loss of more or less of his crop.

The clover root-borer, *Hylastinus obscurus* (figs. 13 and 14), which burrows in the red clover, often destroying whole meadows east of the Mississippi River, winters over in the dead and damaged roots below ground. In spring it makes its way forth and escapes to the fields to lay its eggs in plants not yet infested. These eggs hatch to minute grubs, which destroy the roots by eating them through. One of their favorite breeding places is in such waste lands, and there they constitute a continual menace to the adjacent clover meadows.

INSECTS HIBERNATING BELOW GROUND IN PASTURES AND MEADOWS.

There are several groups of insects that hibernate below ground in pastures and meadows, and among them are some of the most grievous pests of the farmer. The three most important are cutworms, wireworms, and white grubs.

CUTWORMS.

Cutworms, of which there are many kinds, are the young of heavy-bodied, usually more or less dusky-colored, moths or millers that hover about the lights during hot, muggy nights in June and July, especially when a storm is threatening. Indeed, this habit has won for them in some parts of the country the common name of "candle flies." The habits of these cutworms are very much alike, and for practical purposes they may be here considered as one. The eggs are deposited in summer by the moths or millers, and, as they are pri-

[a] Criddle mixture is made by mixing 1 pound of Paris green with 5 ordinary pailfuls of horse droppings, moistening this with about a half pailful of water in which 2 pounds of salt has been dissolved.

Poison-bran mixture is made by mixing 1 to 1½ pounds of Paris green with 100 pounds of wheat bran, moistening this with sweetened water to the consistency of a stiff dough.

marily grass feeders, these eggs are generally placed in grass lands. In fact, this is the only way that the mother insect can protect her offspring—by placing her eggs where the young hatching from them will be the most likely to secure the proper food supply—for before the eggs hatch she will have died.

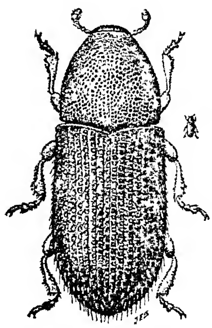

FIG. 13.—Clover root-borer (*Hylastinus obscurus*): Adult insect. Natural size at right. (Author's illustration.)

The young hatching from these eggs begin to feed and increase in size, becoming partly grown by late fall, usually descending below ground and remaining there in a dormant condition. With the advent of spring and warm weather they become active again, ascending to the surface of the ground and feeding as they did the previous fall, only more ravenously. Hence, there are, as will be observed, as many of these cutworms in the fields in the fall as there are in spring, or even more, though the farmer seldom observes them at all in the fall. Thus it is that grass lands of long standing are the worst infested by these pests in spring, and the most serious loss to the farmer by reason of cutworms takes place when he attempts to change from grass to grain, more especially to a crop of corn. A corn crop suffers worse from these ravages, because it is grown more sparingly on the ground and the individual plant therefore becomes more important, and, besides, the tender, succulent plants are in the best possible condition to afford the most attractive food at the time when this is most essential to the life of the partly grown, famishing cutworms.

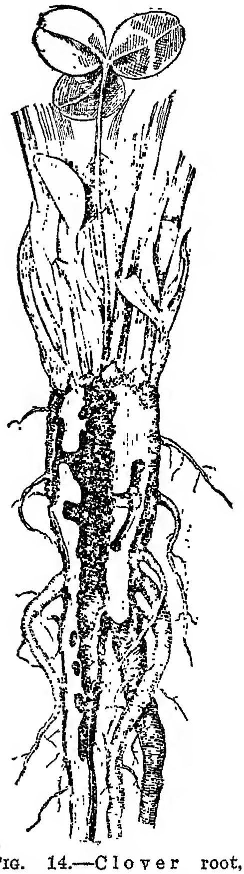

FIG. 14.—Clover root, showing work of the borer *Hylastinus obscurus*. Slightly enlarged. (Original.)

During a few weeks these cutworms continue to feed, after which they burrow into the ground for an inch or so and there construct earthen cells, in which they transform to adults and make their escape. Now, the farmer can be sure of the stage in which these pests are to be found during the entire year; he may inspect his farm and decide with reasonable exactness just where they are, for their occurrence in grass lands is as natural

as it is for water to flow down hill, and his whole effort should be to render these conditions as unnatural as possible. He may break up the grass lands in summer to destroy the food supply of these young cutworms in the fall; he may break up the ground very late, after the underground cells have been formed, thus exposing them to the inclement weather of winter; he may cultivate the land early in spring to complete the destruction of the food supply of the worms, and he may destroy them by delaying his planting until they have perished of starvation. If allowed to live out their natural life the worms do their destruction and reach full growth by middle to late May, when they descend just below the surface of the ground, again construct cells in the earth, and pass into a stage requiring no food, and no amount of treatment is likely to affect them. In a few weeks the moths emerge from the ground and wander about, selecting suitable places in which to lay their eggs. It would seem that every farmer ought to recognize these insects at sight, but frequently one will be told that hot days kill the cutworms because they "bust open" whenever the weather gets hot.

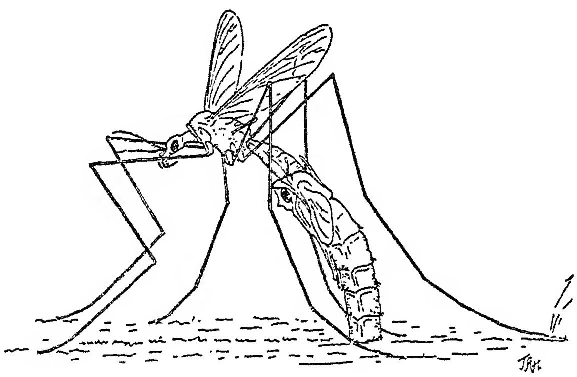

FIG. 15.—Tipula, or crane-fly, emerging from the pupa skin. About natural size. (Original.)

Now, this insect that bursts open is not a cutworm but the pupa of a large maggot, and the fully developed adult is not a moth or miller but a large fly. The fly is known to scientists as a tipulid fly or crane-fly (fig. 15), the commonly applied name being daddy-long-legs. In England the maggots are called leather jackets. These flies deposit their minute black eggs in grass lands and also, in this country, in clover fields. These eggs hatch out minute maggots which become partly grown by the time cold weather begins; they then lie dormant in the soil until early spring, becoming again active and feeding upon the roots. When fully grown these maggots go into the pupal or nonfeeding stage, and when the flies are about to emerge, which is usually about the beginning of hot weather, these pupæ push themselves upward partly out of the ground, burst open, and the flies escape. This is why farmers claim the cutworm bursts open when the weather begins

to get hot. These maggots are destructive to clover and also to grasses, doing damage which is frequently charged up to "winter killing," and if badly infested clover lands are broken up late in the fall and sown to wheat, the wheat is sometimes destroyed, in March, by the maggots. Here is a case in which the farmer ought to know the difference between these maggots and cutworms, because a practical repressive measure applied to cutworms is worse than useless in case of these maggots.

WHITE GRUBS.

The second group of destructive insects with which the farmer should be familiar is the white grub, *Lachnosterna*, or grub-worm, as it is sometimes called. There are numerous kinds of these grubs attacking grains and grass crops, all having much the same habits, to some extent resembling those of cutworms. The fully developed insects are, however, very different, being, instead of moths or millers, large, brown, hard-bodied beetles commonly known as May beetles or June bugs. These names are applied to them in different parts

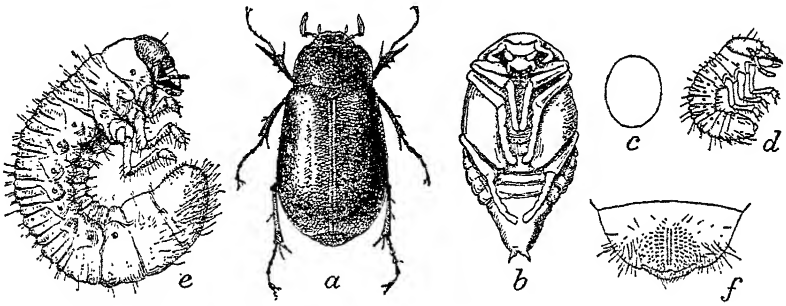

FIG. 16.—May beetle (*Lachnosterna arcuata*): *a*, Beetle; *b*, pupa; *c*, egg; *d*, newly hatched larva; *e*, mature larva or grub; *f*, anal segment of same from below. *a*, *b*, *e*, Enlarged one-fourth; *c*, *d*, *f*, more enlarged. (From Chittenden.)

of the country on account of their abundance during either one or the other of these months. They sometimes swarm about trees in the evening twilight, making a low murmuring noise, frequently being attracted by the evening lamps, and come bumping and humming about the windows. The different stages of development are shown by the accompanying illustrations (fig. 16).

The eggs are deposited in the ground among the roots of grass in late May or June. These eggs are round, white, and about the size of bird shot. They hatch in about one month, and the young grubs feed upon the roots of grasses until cold weather, when they burrow down into the soil and pass the winter, coming near the surface with the warmth of spring. Here they feed throughout the summer and in fall go down into the ground again and pass the winter there. Coming near the surface again they feed as before until late May, in the Northern States, when they go down into the ground again and construct an earthen cell wherein they transform to the fully de-

veloped beetles, and the following spring make their way up and out of the ground. It thus follows that these grubs do no injury the first year and very naturally are more easily killed by cultivation. Generally it is not until the summer and fall of the second year that they begin to destroy the grass or sod to any extent, while the third year they do their greatest damage, especially if the ground is now broken up and planted with corn.

As a matter of fact, the beetles are not attracted to newly seeded grass lands in their quest for a favorable place to deposit their eggs. True to her instincts, the mother beetle will select fields more densely grown over with grass. We know this because it is the older grass lands that suffer most from the ravages of these grubs. If, therefore, the farmer will so rotate his crops as to allow but two consecutive years in grass, it will readily be seen how the ravages of these pests may be avoided, because, with little likelihood of his grass lands being damaged the first year standing, and the breaking up of the two-year-old sod in the fall of the second year being exceedingly fatal to the grubs that have hatched from eggs only a few months before, there will be few or none to attack the young corn the following spring. This measure has the advantage of being practical where crop rotation can be carried out, and it will work out in practice as well as in theory. It is usually in the case of old pastures that are broken and planted with corn that the greatest injury is sustained.

In protecting the corn crop the farmer must bear several things in mind. If he breaks the sod in midsummer and throws the grass roots up to the hot sun and wind, the food supply of these grubs will be destroyed; if he breaks very late, after the grubs have gone into winter quarters, he destroys these to some extent and renders the conditions very unfavorable for the remainder. If he allows no vegetation to start on the land in spring until late, say the last of May in the latitude of northern Ohio, Indiana, and Illinois, and in Iowa, the weaker grubs will be starved and the oldest will have passed out of the destructive stage and thus the corn plants will escape destruction. In case of hillsides, where the land washes easily, summer or fall breaking is to be avoided as much as possible. Here it is best to break the sod very late in spring, say after May 20, for the latitude just indicated, and plant the corn immediately. This plan will eliminate the oldest of the grubs, as these will have passed into the nonfeeding stage, while the roots in the overturned sod will suffice to keep the remainder supplied with food until the corn has generally become too far advanced for them to injure it. In all of this the farmer has simply been so shaping his agricultural methods as to render his fields as nearly uninhabitable for the pests as possible, but he never can accomplish this without a knowledge of the conditions best suited to their necessities.

WIREWORMS.

Wireworms are the offspring of click beetles, and though they differ radically in appearance from the white grub, in all stages of development, these pests must be managed in much the same manner, because of very similar habits. They frequent the lower lands. Both the worm and the adult insect are shown in the accompanying illustration (fig. 17).

CORN BILL-BUGS.

In the corn bill-bugs we have a different life history and a variation in the nature of attack, but agreeing with the foregoing in that they are the result of long-standing timothy and other grass fields or swamp lands. Primarily, they are not corn insects at all, but, owing to the agricultural methods in vogue among many farmers, they are forced to attack the cereal in order to escape starvation. One of these so-called bill-bugs which attacks timothy is *Sphenophorus venatus*. It has no common name and is hardly distinguishable by the unscientific from several other species. This does not matter, however, as what may be said of one will apply to the others. The fully developed beetle is illustrated in figure 18. It is small, black, with a long snout, at the end of which are the mouth and jaws.

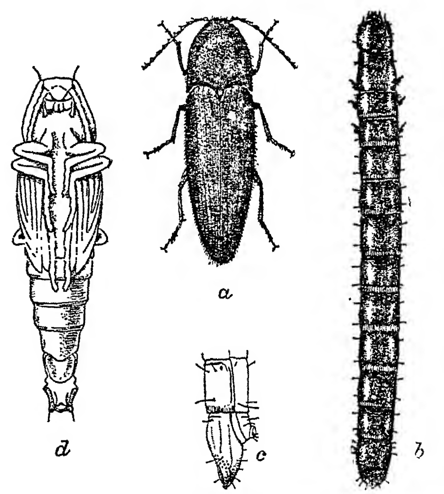

FIG. 17.—The common wireworm (*Melanotus communis*): *a*, Adult or beetle; *b*, larva, or wireworm; *c*, anal segments of same, more enlarged; *d*, pupa. All enlarged. (Original.)

In late May or early June the female gnaws a minute hole in the stem of timothy, usually just above the bulbous root, in which she places a small, elongated white egg. This egg hatches to a robust, white grub with brown head and jaws. Though working upward in the stem while young it later burrows downward into the bulbous root, feeding on the substance thereof and leaving the cavity thus made filled with excrement and bits of stem, that when dry become a compact powder. Although this work is usually done too late to affect the growth of the stem or the hay crop, the feeding goes on in the stubble after the hay has been removed; the roots are killed, sending up no aftermath, and the dead stubble may now be easily pulled up. Sometimes patches including

several acres are killed out in this way. When the grub has become full-grown, it leaves the stem and works its way into the surrounding soil, where it constructs a cell and in this it develops to the beetle. This does not, however, leave the field, but remains until the following spring. If the field is allowed to remain in timothy the insects go through the same operation the following year and the damage is usually much greater. Finally the farmer decides that something is the matter and breaks up his meadow, generally in April, and plants his corn early in May.

About the time the beetles are casting about for something to eat and plants in which to lay their eggs, the timothy has been exterminated, the young corn has made a sufficient growth, and the plants are punctured by the beaks of the pests, the leaves being riddled with holes. Frequently whole fields are destroyed at this time and replantings are also ruined. In this case a fresh supply of food has been offered just at the time when the insect was in the most dire extremity, and nothing could have been better devised to supply its immediate needs. Fall plowing, spring cultivation, and a small delay in planting would have prevented the destruction, as the insects would either have perished or been driven out of the field.

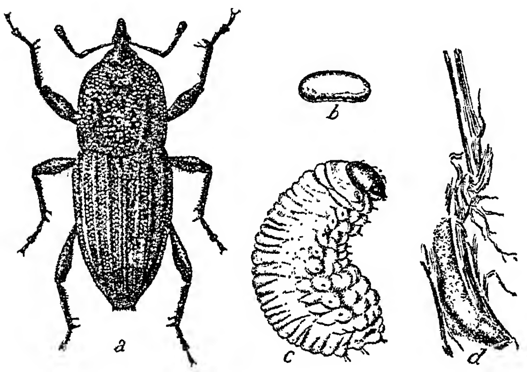

FIG. 18.—Timothy bill-bug (*Sphenophorus venatus*): *a*; Adult, or bill-bug; *b*, egg; *c*, larva; *d*, work in timothy stem. *a*, *c*, considerably enlarged: *b*, greatly enlarged; *d*, about natural size. (Original.)

A similar but larger species of the bill-bug, *Sphenophorus æqualis*, is in nature a perfectly harmless creature. It inhabits swamps and marshy lands, feeding on reeds and rushes, breeding in the bulbous root of *Scirpus*, a reed with a three-cornered stem (fig. 19). But as soon as the attempt is made to reclaim these swamp lands and grow a crop of corn on this land trouble begins. In at least four cases out of five the effort will be made to grow a crop of corn on this land in the process of reclamation and before the original swamp vegetation has been destroyed, and in very many of these cases the crop will be ruined by the punctures of the beetles, made either for the purpose of laying their eggs in the plants or for obtaining food. If rye were to be sown as the first crop, and the plowing so timed as to destroy the native swamp flora, the loss could be easily avoided.

INFLUENCE OF WEATHER.

That insects, both injurious and beneficial, are much influenced by the weather is well known, but frequently this influence is quite the contrary to what is commonly supposed. Excessively cold weather in winter is often said to be fatal to insect life, but this is only in part true. In the northern parts of the country severe winters are not necessarily fatal to hibernating insects, provided the low temperature is continuous. Here it is the occasional radical changes from warm to very cold that are fatal, continuous cold being, if anything, rather favorable to insect life. As we proceed southward, however, this condition changes, as in the warmer sections insects are not fitted to withstand such abnormal conditions and are more rarely able to survive extraordinarily low temperatures, and when seasons with such low temperatures occur they are more or less fatal to many forms of insect life, though not to all. In the northern sections, then, whatever the farmer can do to accentuate the effects of exposure and changes in temperature will be to his advantage. If matted grass, fallen leaves, and rubbish are cleared away in the fall, such insects as hibernate above ground are driven to quarters less protected from these sudden changes and from the cold, drenching rains. If such places are burned over in late fall or winter, either in the North or in the South, myriads of insects are destroyed, and thus the fatalities of winter are much increased. Thus it is that, with insects only partly developed and passing the winter below ground in earthen cells, if their winter quarters are broken up or rendered more exposed to sudden changes of temperature or to drenching rains, by fall or winter plowing, the mortality will be increased.

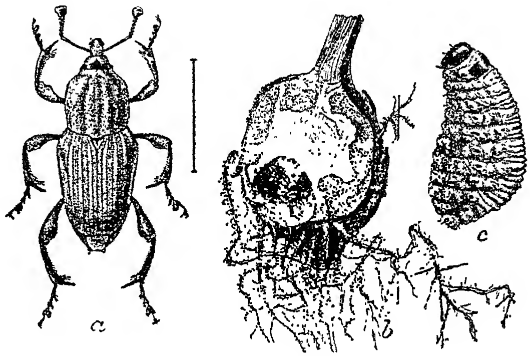

FIG. 19.—Corn bill-bug (*Sphenophorus æqualis*): *a*, Adult or beetle, enlarged; *b*, work of bill-bug in roots of rush (*Scirpus*), natural size; *c*, larva, enlarged. (Author's illustration.)

For the same reason an exceptionally early winter is fatal to many insects because it catches them unprepared. One of the best illustrations of this fact is afforded by the Hessian fly. An exceptionally

early winter finds millions of the maggots not sufficiently advanced to withstand the winter, and if caught in this condition they perish. On the other hand, a prolonged warm autumn, especially if extending into early winter, enables these millions of young to become so advanced in development as to be able to live through the severest winter. A prolonged cold, wet spring is very favorable for the increase of some of our most destructive insects, not perhaps because they flourish best under such conditions, but because their natural enemies are kept inactive, and released from this restraint they suddenly jump, as it were, into destructive abundance. Whenever there occurs one of these cold, backward springs there is always more or less trouble from attacks of cutworms, army worms, and various kinds of aphides, or "plant lice." There will probably never be a serious outbreak of the "green bug," *Toxoptera graminum*, except during a cold, backward spring preceded by a mild winter, especially in the South.

The effect of drenching rains is perhaps most pronounced on the chinch bug. The fully developed chinch bug will withstand almost any amount of rain, but when hatching from the egg a drenching rain is fatal to the very young. In fact this is probably by far the most powerful element of restraint governing the fluctuation of this pest in numerical strength and destructiveness. So true is this that it is impossible to predict an outbreak even a few weeks in advance of its coming. As illustrating this point, myriads of young may develop in the wheat fields, some little damage may be done, and the young may all reach full development, thus indicating trouble in that section another year. But these bugs lay their eggs in late summer and die. If, when these eggs are hatching, there is a period of dry weather, they will increase greatly and go into winter quarters in vastly greater numbers. But if, during the few weeks while these eggs are hatching, there are frequent drenching rains, most of the young will be killed and all danger of this outbreak the next year, so apparent a few weeks before, will have disappeared. Indeed the matter may go even further and the fall brood go into winter quarters in numbers sufficient to render an outbreak in the wheat fields the following year just before harvest seem inevitable. But the wintered-over bugs lay their eggs in late spring and then die. Now, just at this critical point, when there are millions of eggs to the acre in the fields, and these eggs begin to hatch, there come drenching rains and the young are killed to such an extent that there are not enough left to do any injury, whereas had the weather during this especially critical though very short period been dry, the bugs would have literally swarmed in the fields and worked their ravages there.

That winds have much to do with the dispersion of insects is well known, especially when the breeding season is at hand and the females are on the wing. There can hardly be a doubt that the prevailing southerly winds in spring do much, in seasons of excessive abundance of the "green bug," to spread the pest from Texas to the northward and greatly aggravate its ravages there. This movement is of course accentuated because of the continual advance of spring from the South northward, thus furnishing a continually fresh supply of food. If strong north winds prevailed at this time and the winged females were driven in the opposite direction, the problem north of the Red River relative to this pest would probably become far more simple.

The Hessian fly offers another apt illustration of the influence of winds. There may be in a neighborhood a field that has been very seriously infested by this pest, while on either side there may be others practically free from it. Now, at the time of the emerging of the females, if there is a perfect calm the flies will wander out from this field where they originated, in approximately equal numbers in every direction. But if just at this critical time the wind blows continuously from a certain quarter, it will cause the flies to drift with the wind, and to such an extent may this occur that fields in the direction from which the wind is blowing may escape with little infestation, while those in the opposite direction may be overwhelmed on account of the carriage of the whole force of flies in that direction by the winds. The writer has several times observed fields to be seriously damaged through this cause, even where the owner had taken every precaution, by late sowing, to keep his field free of the pest, and so far as lay in his power succeeded, while another in the opposite direction, who may have done little or nothing, escaped with even less loss than his more enterprising fellow-farmer.

While all of these phenomena are perplexing, some of them even to those who understand the nature of the insects involved and the influences that direct them, very much of this obscurity and mystery will disappear if the farmer will only study and learn something of these elements with which he is and always will be obliged to deal. They are really not so much more complicated than those that confront him in the different varieties of grains, all of which have separate characteristics, and will grow and act differently on different soils and in different localities. Nor do they differ radically from his domestic animals, with which he must be familiar even to individual traits in some cases, notably his horses.

CONCLUDING REMARKS.

These are some of the things that an up-to-date farmer must know and understand in order to be able to meet and overcome the ravages of insect pests in his fields. These outbreaks of insects are brought about, very often, by his own agricultural methods, and where this is the case he of all men should be able so to revise these methods as to work to the disadvantage of the pests and eliminate more or less of these enormous losses. But he can not hope to do this without a working knowledge of the habits and ways of living among the things he hopes to control.

PLANT FOOD REMOVED FROM GROWING PLANTS BY RAIN OR DEW.[a]

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REVIEW OF PREVIOUS INVESTIGATIONS.

The relation between the ash content of the plant and the salts of the soil upon which it grew has long been the object of scientific research. Since Liebig advanced the theory of the application of fertilizers, many investigators have been led to believe that a definite relation must exist between the plant foods of the soil and those taken up by the roots of the plants and contained in the sap and tissues of the matured crop.

During the sixth and seventh decades of the nineteenth century considerable work on the variations in percentage and composition of the constituents of growing plants was accomplished by many German investigators, who noted that certain ash constituents of plants, instead of increasing gradually until the plant was ripe, tended toward a maximum at or near the heading period, and then gradually decreased until harvest. Long before the work of these men had been published, however, Professor Norton, of Yale, had made the first chemical study of the oat plant at various stages of growth. From that time until the present, many investigations of plants during the growing period have been made, but the most elaborate work is one which has recently been published, namely, that of Wilfarth, Römer, and Wimmer, in which the authors try to prove that a portion of the absorbed plant food is returned to the soil, i. e., that there is a translocation of plant food from the plant back through the stems into the soil.

It had frequently been observed that growing cereals when near maturity contained less potash, lime, magnesia, nitrogen, and phosphoric acid than at the period just before heading, the period during which great activity is apparent. Such losses in plant-food constituents were ascribed to various causes, but generally to a translocation of these elements. In other words, it was maintained that

[a] This work is the result of collaboration of the Laboratory of Vegetable Physiological Chemistry of the Bureau of Chemistry with the Office of Grain Investigations of the Bureau of Plant Industry.

these plant-food materials were returned to the soil by a physiological process. Sometimes, when an author found less ash ingredients in plants at the period of maturity than at a preceding period, he explained the apparent loss as due to the weathering of the dead and wilted leaves.

WEHMER'S CONCLUSIONS.

In 1892 Wehmer reviewed some work done along this line by many of his predecessors and concluded from their data (he did not in this case report any of his own work) that it was quite possible to explain their results on the assumption that the salts had been washed out of the dead cells by rain. His observation was certainly nearly correct, although based upon figures obtained by others, and which had been used in explaining this loss as due to a physiological cause.

Notwithstanding the fact that Wehmer published his criticism in 1892, many other investigators, and chief among them the Germans, have continued the old line of research and have interpreted the loss of plant-food constituents as due to a variety of causes; indeed some of their results go to show that no great loss could have taken place through the washing out of soluble salts by the action of rain. Such conclusions were reached by several students who directly opposed the theory of Wehmer that a considerable extraction of ash constituents of the leaves by rain takes place. Wehmer's theory was opposed to so great an extent that it seems to have been relegated to the background.

In Storer's Agriculture results are given to show that the amount of plant food found in the matured plant represents the amount of plant food required by such plants.

It has, of course, been known for a long time that when hay has been cut and exposed to the action of rain it loses about one-half of its ash ingredients. Johnson, in his book How Crops Grow, calls attention to this fact, but concludes that it has not been proven that rain exerts such a dissolving influence on the uncut vegetation also.

That there is a very active physiological force at work in plants effecting the translocation of plant-food constituents can not be denied. For example, it is a well-known fact that some plant-food constituents, at the time of the heading and maturing of the plant, are translocated from the leaves and stems to the head and grain or seed. Some results along this line have been obtained by many investigators, who have generally shown that a backward flow of the soluble salts of the leaves to other parts of the plant takes place. These materials are conducted by the sap from the leaves and stems into the remaining organs and there stored as reserve material for the next generation or growing period.

INVESTIGATIONS OF WILFARTH, RÖMER, AND WIMMER.

The more elaborate work of Wilfarth, Römer, and Wimmer, previously mentioned, covered numerous researches both in the greenhouse and in the field, with a variety of plants, especially wheat, barley, peas, and potatoes, analyzing their various parts at four or five different periods of growth, for dry matter, starch, potash, soda, nitrogen, and phosphoric acid. In the case of barley and wheat grown in the field and examined at four different periods, the authors noted that the maximum amount of the various substances per acre was as follows: Starch at the fourth or "ripe" period; dry substance, phosphoric acid, and nitrogen at the third period, and potash and soda at the second period or period of bloom. Thus it appears that as the plant ripened it suffered a gradual loss in dry matter, nitrogen, phosphoric acid, soda, and potash. The loss of dry matter was practically inappreciable and may be mostly or entirely due to the fall of dried or decayed leaves. The loss of phosphoric acid is likewise very small, thus indicating that the plant continues to take up this element until very late in its life history. With soda and potash, however, the loss is considerable, amounting to 47 per cent in the case of the former and to 38 per cent in the case of the latter. This means that after the period of bloom had passed, which was the period when the plant contained its maximum of soda and potash, the plant gave off, by one means or another, 38 per cent of its potash, 47 per cent of its soda, and 23 per cent of its nitrogen.

These authors interpret their results by assuming that "a part of the food constituents which were necessary for the formation of the various plant substances, but which were not stored up as reserve material, was returned to the soil on approaching maturity." This process of returning plant food to the soil is assumed to be purely physiological—that is, a downward flow of the ash-laden sap through the vessels of the stems and roots.

No attempt will be made to disprove the statement that the plant food was returned to the soil; only the manner in which this is brought about is questioned. Years ago Johnson called attention to the fact that the mineral substances of plants exude upon the surface as an efflorescence and are washed off by rain. This statement, however, applied only to the cut and injured vegetation, there being no data to show that growing plants also lose some of their absorbed material in the same way. As before stated, Wehmer explained the loss of material suffered by growing plants as due to the action of rain, and this theory was combated by many of the later investigators. The loss of plant substances found by Wilfarth, Römer, and Wimmer was so great that Liebscher's theory (that this loss was due to the withering and decay of portions of the plant)

does not hold; for if true, there would likewise have been a corresponding loss of phosphoric acid and of dry matter. As the loss noted applied to the whole plant, it was not a question merely of translocation (though this physiological process played a very important part, as it always does, during the growth of the plant), but it was a question also of plant excretion.

WORK OF SWISS INVESTIGATORS.

The same conclusions were drawn by Swiss investigators in their work with oats. They likewise found, on analyzing the oat plant at different stages of growth, that the total amount of mineral constituents in the oat plant decreased from the time of flowering—that is, after about the fiftieth day of growth. From that time to maturity the assimilation of plant food ceased. In fact, assimilation not only ceased altogether, but there was a decrease of total dry matter as well as of total ash ingredients. The decrease in nitrogen and lime was comparatively slight, but quite large amounts of silica, potash, phosphoric acid, and iron were lost. The loss of some of these constituents amounted to as high as 40 per cent. This is explained as being due to a migration of salts back to the soil, the same conclusion as was announced by Wilfarth, Römer, and Wimmer. Their results in working with the carrot plant showed, as did the results of Wilfarth, Römer, and Wimmer, that only the portion of the plant above ground suffered any loss. The roots maintained a constant increase in plant constituents up to maturity, and at no time did they show a decrease. These authors have explained their results as being due to a physiological process of secretion.

LATER WORK.

More recent work on sugar beets, by some Austrian investigators, shows that during the later period of growth the sugar beet loses appreciable amounts of potash and slight amounts of nitrogen and phosphoric acid. This loss is explained by assuming a fault in sampling. The loss was entirely in the leaves or the portion of the plant above ground. While some of these investigators indorse the views propounded by Wilfarth, Römer, and Wimmer, others absolutely reject the theory of plant food secretion by the roots. Another explanation for the observed loss of plant food in beets on ripening is that this loss may be attributed mostly to the drying and falling of leaves (occasioned by weathering, e. g., by wind and rain).

All of these observations, except those of Wilfarth, Römer, and Wimmer, were made on plants grown out of doors, and therefore subjected to all the climatic agencies.

In a still later experiment, however, carried on in the greenhouse, it has been shown that when beans are grown there is no decrease of

potash, phosphoric acid, or nitrogen at any time during growth. This is entirely opposed to the results of Wilfarth, Römer, and Wimmer, who observed appreciable loss both in the greenhouse and in the field. The only explanation of the losses observed in the greenhouse by those authors is that the plants grown under those conditions have been watered in such a manner as to wet the plants themselves, instead of watering only the soil.

SOME EXPERIMENT STATION WORK.

In 1893, Dent and Patrick[a] studied the loss not only of the total ash but also of the ordinary feeding constituents of fodder corn, from the green matured stage to the time when the leaves were completely dried. During this time, namely, from September 20 to October 12, four samples were analyzed. The results showed that a considerable translocation of the elaborated material took place from the leaves and stems to the ear, the weight of the ears increasing up to the last period, while the weight of fodder had reached its maximum some time in September and then appreciably decreased. The loss in weight which took place was principally from the husks, leaves, and stalks. This loss was noticed in the case of ash, fat, fiber, and nitrogenous compounds. On the other hand, the cobs showed very little if any loss, while the kernels showed an increased amount of the above-mentioned constituents up to the time of full ripeness. During this whole period no rain fell, so that the loss noted can not be due to that agency. However, at this time of the year much dew is formed and that would probably cause the small loss of ingredients actually noted. At the same time it was almost impossible to prevent some mechanical loss of the dried leaves.

The point at issue in all of the work reviewed is the explanation of the loss of plant food so universally observed in the field when the plants are grown to maturity. There are three hypotheses for explaining this loss:

(*a*) The backward flow of the salts of the plant juices through the stem and roots to the soil.

(*b*) The decay or drying and falling off of leaves.

(*c*) The action of rain, dew, winds, and other climatic agencies, or a combination of all these causes to a limited extent.

DEPARTMENTAL EXPERIMENTS ON THE TRANSLOCATION OF PLANT FOOD IN WHEAT.

In the fall of 1907, some time after the publication of the results of Wilfarth, Römer, and Wimmer, the work herein to be described was undertaken. A series of Wagner pots, holding 50 pounds of soil

[a] Iowa Agr. Exp. Sta. Bul. 21.

each, was set up in one of the greenhouses of the Department of Agriculture and sown with Fretes wheat. Throughout the growing period the plants were watered by hand, care being taken to allow no water to touch the foliage. About the middle of January, before the plants had begun to head, several of the pots were attacked by blight, which either killed the entire plant by a slow process or else killed only the tips of the leaves. At this stage, that is, before heading, several comparative samples were taken from the same pots. These samples consisted of the dead tips and live tips of live leaves, and the live butt-ends of the same; the total dead leaves from dead stalks; the live leaves and the dead leaves respectively of live stalks; the upper nodes and lower nodes respectively of dead stalks and the same from live stalks, and the dead heads and live heads from live stalks.

These samples were all analyzed for nitrogen, potash, and phosphoric acid, the results showing that in the period before heading the nitrogen and potash content of the part of the plant which is dead is generally lower than that of the adjoining live portion, e. g., the dead tips of leaves are always poorer in nitrogen and potash than the live portions of the same leaves. The nitrogen content of the dead leaves is always lower than that of the live leaves, whether the dead leaves are attached to dead or to living stems. These results show that as the plant part dies, or is in the process of dying, the nitrogen tends to recede to the living portion of the plant. That this recession or translocation is upward and not downward toward the soil is shown from the fact that the nitrogen and potash content of the lower nodes, whether they be dead or alive, is considerably less than that of the upper nodes. In general the upper portions of plants are richer in ash constituents. Were there a downward flow the tendency would certainly be to make the lower nodes richer in these constituents. The variation in the nitrogen content is considerable in the different parts of the plant, the live lower nodes containing only 1.71 per cent, while the dead upper nodes contain 5.26 per cent. Normally the live leaves contain more nitrogen than do the live stems. The dead leaves are, however, lower in nitrogen than the dead stems to which they belong, because their nitrogen has been transported to the stem; that is one reason why the dead stems are richer in nitrogen than live stems whose leaves are still sound.

When the course of potash is thus followed, several apparent contradictions appear; for example, the dead leaves on live stalks contain over 5 per cent of potash, while the live leaves on live stalks contain but 3.8 per cent. This may be because the live leaves, having lived longer, have through assimilation produced more organic matter, thus reducing the percentage of ash and of potash. Another reason is that there is not the same tendency for the potash to be trans-

ported toward the seed as for the nitrogen, the potash remaining in the leaves so as to keep up the work of assimilation as long as any green matter is present. There is little tendency at this stage for the nitrogen or the potash to migrate downward to the soil.

In discussing the translocation of plant food after the heading period the chief point shown by these results is the utter failure to note any backward flow of potash, nitrogen, or phosphoric acid through the stem and roots into the soil. As in the case before heading, there is a movement or translocation of these salts from the dead tip to the live portion of the leaves. The nitrogen, in the samples analyzed after heading, follows identically the same course as in the samples before heading, thus showing that the movement is upward toward the seed. This is further proven from the fact that the dead heads, though containing no seed, are richer in nitrogen than are the live ones, because plants, in dying prematurely, always strive to reproduce their species, and in their attempt at reproduction this accumulation of nitrogen or protein material in the head is necessary.

The course followed by phosphoric acid is identical with that of nitrogen, the whole tendency being for the phosphoric acid to migrate from the dying tissue to the living, and toward the head. No evidence of a downward flow to the soil is noted either with nitrogen or with phosphoric acid.

In the case of potash it is again noted that after heading it behaves more as it did at the period before heading, and quite differently from nitrogen and phosphoric acid. Again, the live leaves contain a smaller percentage of potash than do the dead leaves, and for the same reason as previously noted, namely, the potash is required to produce organic matter, which makes these leaves contain a larger per cent of starch, protein, etc., but relatively less ash and potash. Wilfarth, Römer, and Wimmer's experiments brought out the fact that the heads of wheat or barley contain about 70 per cent of the whole nitrogen of the plant, 75 per cent of the phosphoric acid, 26 per cent of the potash, 13 per cent of the soda, and 90 per cent of the starch. It will thus be seen why there is such a great movement of some of these elements, particularly nitrogen and phosphoric acid, toward the head, and why, on the other hand, some elements, like potash and soda, are found in such large amounts in the straw, these latter showing very little tendency to migrate to the head. These noted authors found that at the period of bloom 70 per cent of the nitrogen was in the straw. At the conclusion of the experiments—that is, at the maturity of the plant—they noted that 23 per cent of the assimilated nitrogen had been lost, together with about 38 per cent of the potash, 47 per cent of the soda, and 3 per cent of the phosphoric acid. This loss, as before stated, was assumed to have been due

to a downward current of the sap through the stems and roots into the soil. Yet when the roots of barley and wheat are examined there is no evidence of any increase of these various constituents (but rather there is a decrease) from the first period to the fourth period, or time of maturity. Had there been a recession of the nitrogen, potash, soda, or phosphoric acid through the roots into the soil the percentage, or at least the total absolute amounts, would have increased with the approaching maturity of the plants.

DEPARTMENTAL EXPERIMENTS ON THE EFFECT OF LEACHING.

Having shown that there is a migration of plant food from the dead to the living tissue, and that the nitrogen and phosphoric acid flow upward toward the seed, whereas the potash remains for the most part in the stem and leaves, because it is essential to the elaboration of starch by chlorophyl, and, further, that there is no evidence to prove any downward movement of plant-food constituents, it is now only necessary to give data proving that the loss of these ash materials actually suffered by maturing plants may be due, not to a physiological or biological process, but to the simple mechanical action of rain, dew, etc.

To determine the effect produced by these agencies the following experiments were carried out, various plants being used and the leaching conducted under different conditions, in some cases simulating rainfall and dew as nearly as possible.

BARLEY.

A sample of greenhouse barley at the heading period was harvested and then the whole plant was subjected to leaching; that is, the plant was placed in a large evaporating dish and soaked with water for several minutes. After drying, this operation was again repeated. The plant was then again dried and analyzed. The washings were also analyzed, the results showing that 1.6 per cent of the whole nitrogen of the plant was lost on washing or soaking, 36 per cent of the phosphoric acid, 65 per cent of the potash, 52 per cent of the soda, 45 per cent of the magnesia, and 75 per cent of the chlorin. While this process of washing or soaking the cut plant may not be analogous to the effect produced by rain in the field, other experiments conducted by the authors show that it is quite probable that rain is the cause of most of the loss of plant food from plants during the growing period.

RICE PLANTS.

A pot of rice plants, which were still green and the heads unmatured, was tilted over a large evaporating dish, and washed with about 2½ quarts of distilled water by means of a very fine spray, the

action of the rain being imitated as nearly as possible. The plants were then cut, dried, and ashed, and analyses made both of the ash and of the leachings of the green plant. These results likewise showed a considerable loss of mineral constituents.

WHEAT PLANTS SUBJECTED TO SOAKING.

Another similar experiment was conducted as follows: At three periods of growth—bloom, early ripeness, and full ripeness—wheat plants grown in the greenhouse were harvested and separated into (*a*) stems and straw, and (*b*) heads. These were separately washed or soaked for from five to ten minutes and the wash water was analyzed, as were also the dried stems and straw and the heads.

The results of the analyses showed that as the plant matures an increasing amount of the plant-food constituents is capable of being washed out by rain. Thus at the first period (plants in bloom) the amounts washed out of the straw and leaves were as follows: Nitrogen, 1.4 per cent; phosphoric acid, nothing; potash, 4.4 per cent; soda, 12.7 per cent; lime, nothing; magnesia, 10.3 per cent; chlorin, 7.6 per cent. On the other hand, at full maturity the amounts washed out had all increased, being as follows: Nitrogen, 7 per cent; phosphoric acid, 33 per cent; potash, 54 per cent; soda, 41 per cent; lime, 34 per cent; magnesia, 46 per cent; chlorin, 60 per cent. Thus it is seen that even when in bloom a considerable amount of plant food is removable by washing, and no doubt by rain. It is not contended that the green plants give off very much of their plant food by such treatment, for it is very probable that most of the ash ingredients removed by washing are those which were in the dead or wilted tissue, as it is well known that when plants dry or wilt the inorganic constituents exude to the surface, where they may easily be washed off if subjected to the action of rain, dew, etc. As illustrative of this, an experiment made with freshly cut grass showed that when the grass was dried previous to treatment with water a much larger amount of ash materials was washed out. This explains why it is that when freshly cut hay has been rained upon it is only slightly injured, whereas if the rain comes after the hay has been dried the loss is considerable, sometimes as much as half of the ash ingredients being thus removed.

FRUIT TREES.

In Bulletin 265 of the New York Agricultural Experiment Station are published the results of an investigation the object of which was to show the amounts of nitrogen, phosphoric acid, potash, lime, and magnesia used and required by fruit trees during one growing season, and the work was so planned that "the fruit, leaves, and new

growth of wood as represented by the tips of branches were carefully gathered, weighed, dried, and analyzed in the case of each individual tree." The trees were protected from loss of leaves by inclosing them with mosquito nettings, and the foliage was left on the tree until it showed a tendency to drop, or until late in the growing season.

The results of this work were interpreted as showing that during the growing season a fruit tree required relatively about 1 pound of nitrogen; 0.27 pound phosphoric acid; 1.14 pounds potash; 1.35 pounds lime, and 0.45 pound magnesia. In the bulletin no mention is made of the possibility of loss of plant-food constituents caused by climatic agencies. To show that in this experiment the results obtained may have been much too low, owing to the dissolving action of rain on the leaves of the trees, the following experiment was undertaken at this Bureau:

Two samples of apple twigs containing green leaves were gathered after about two weeks of drought, and, without removing the leaves from the branches, were washed a few minutes with distilled water. The twigs were then set aside with their butt ends (or stems) immersed in water until the leaves were thoroughly dead, when they were washed again, and analyses made of both washings and residue.

The results of the analyses showed that the leaves had lost on washing, or through the action of water, about 3 per cent of nitrogen, 25 per cent of phosphoric acid, 18 per cent of potash, 22 per cent of soda, 6 per cent of lime, 12 per cent of magnesia, and 40 per cent of chlorin. While not so marked as in the case of some cultivated crops, these figures indicate that the leaves of trees follow the general order of other vegetation in giving back a certain percentage of their salts to the soil. Further, it is shown that this is not due to any complicated physiological process, but simply to the dissolving action of rain water on the mineral constituents which have been exuded upon the surface of the leaves.

WHEAT PLANTS SUBJECTED TO FOUR RAINFALLS.

That the loss of plant food will take place when the plant is ripe, whether the plant be cut or be left standing, is conclusively shown by the following experiment: Two pots of wheat were grown in the greenhouse. The plants were allowed to become dead ripe, after which the pots were placed out of doors, where the plants were subjected to four rainfalls, on separate days. The pots were so arranged that the rain, after falling off the plant, was caught in a tray, thus coming in contact only with the plants. The results indicated that the four successive rains, the total of which amounted to about

an inch, dissolved from the plants the following amounts of plant-food constituents: Nitrogen, 27 to 32 per cent; phosphoric acid, 20 to 22 per cent; potash, 63 to 66 per cent; soda, 46 to 65 per cent; lime, 51 to 59 per cent; magnesia, 54 to 62 per cent, and chlorin, 90 per cent. These results fully corroborate the statement made early in this article that hay may lose as much as half of its ash ingredients on being washed by rain.

OAT PLANTS.

Another experiment was conducted with the oat plant. As soon as the plants were about 8 inches high two pots of oats were placed out of doors and so tilted over that the trays caught the rain, as was done in the previous experiment. The plants were allowed to grow in this position until they were ripe, being subjected in the meantime to the action of three rains. The rain waters were then analyzed, as were also the plant residues, and the results showed the following loss of constituents: Nitrogen, 2 per cent; phosphoric acid, 33 per cent; potash, 36 per cent; soda, 23 per cent; lime, 40 per cent; magnesia, 45 per cent; and chlorin, 40 per cent. The greatest loss took place, however, as a result of the third and last rain, which occurred at a time when the plant was nearing maturity, while the first rain removed comparatively small amounts of plant-food constituents. In fact, at the early stage of the plant's growth the loss taking place is more than made up by the further assimilation of plant food by the roots. From the ripening to the dead-ripe period, however, the salts formerly held in solution by the sap were evidently diffused through the tissues to the surface and washed off by the rain. That this takes place every year whenever the ripe crop is caught in a rain is well known, and seems to be one way that nature has of protecting the soil from rapid depletion. The plant takes up a great deal more plant food than it retains at its maturity. Possibly the plant requires this excess of food in order to elaborate organic matter and perform the other functions of its existence, but when all of its tissues are builded, and its seed is ripe, the excess of these ingredients is given up to the soil (not through any complex physiological process, but as the simplest result of natural phenomena), in order that the next generation of plants may have at its command an abundance of soluble and available plant food.

THE POTATO.

In the course of their elaborate experiments Wilfarth, Römer, and Wimmer found that the potato did not behave as did other plants in reference to the return of the salts to the soil, but that the total salt content gradually increased until the plants reached the dead-

ripe stage. In order to determine whether the potato was an exception to the general rule, two pots were planted and grown in the greenhouse until the plants were about 24 inches high. They were then washed with 2½ quarts of distilled water by means of a very fine spray. This was repeated when the plants had begun to ripen and again when they were dead ripe. The portions of the plants above the ground were then harvested, and the crop, together with the wash waters, analyzed. The results showed that in the case of the potato also the portion of the plant above ground suffered the following losses of plant-food constituents, due to the action of spraying: 7.5 per cent of nitrogen, 52 per cent of phosphoric acid, 36 per cent of potash, 20 per cent of soda, 9 per cent of lime, 12 per cent of magnesia, and 50 per cent of chlorin.

It will be clearly seen from the foregoing results that the potato is not an exception, but follows the general rule in giving up a considerable portion of its soluble salts to the soil as it approaches maturity. As the greater part of the potato is below the surface of the soil, and as the tubers continue to develop even after the plants have reached maturity, this loss of plant food from the tops might easily be overlooked in an analysis of the entire plant. However, when the results of Wilfarth, Römer, and Wimmer are carefully examined, it is seen that they also show that the ash constituents of the tops of the potato plants decreased in absolute amounts, especially during the last two periods, though, as was stated before, the amount of these constituents in the total plant increased from the beginning to the end of vegetation.

APPLICATION OF RESULTS TO DETERMINATIONS OF PLANT FOOD REQUIRED BY A CROP.

It is thus manifestly impossible to determine the plant-food requirements of plants, or of trees, by simply analyzing the product of the year's growth. Nor is it possible to determine the relation between the various constituents required by plants by a final analysis of the crop; for it is very evident that some substances are washed out earlier, and in larger amounts, than others. Therefore in all pot and plat experiments hereafter conducted in order to determine the amount of plant food absorbed or required by plants, the large amount of ash ingredients removed from the plants by rain, dew, etc., should be taken into account. The amount of mineral constituents left in the plant or tree at harvest does not in any true sense represent the amount of plant food required by that plant, but simply represents what has been left in the plant after the climatic conditions have exerted their dissolving influence on the absorbed constituents.

If the amount of salts removed by rain be calculated to an application of fertilizer containing these elements, the importance of the effect of rain on plants can more readily be seen. From our results it seems quite possible that at least 20 per cent of the total amount of nitrogen, 30 per cent of phosphoric acid, and 65 per cent of potash can be readily removed by rain from a crop of wheat.

A good crop of grain and straw will amount to about 4,000 pounds dry weight per acre. The percentage of fertilizer salts contained in the dry plant not previously washed by rain will amount to something like 1.97 per cent of nitrogen, 0.50 per cent of phosphoric acid, and 3.5 per cent of potash, as shown by greenhouse tests. Calculating the percentage loss to the basis of some ordinary fertilizer, these figures are equivalent to about 700 pounds of kainit, 100 pounds of sodium nitrate, and 36 pounds of 16 per cent acid phosphate per acre removed from the dead plant, and either returned to the soil or lost by surface washing. The importance of retaining this wash water in the soil can not be overestimated.

It has long been noticed that soil used for pot cultures in greenhouses becomes exhausted very much sooner than the same soil does when exposed to the atmospheric agencies either in pots or in the field. The continued removal of the greenhouse crops containing the plant foods which in the field would be returned to the soil would certainly tend to decrease its fertility.

In the same way pot cultures when grown in greenhouses are usually much richer in salts than field crops of the same variety. In fact, some wheat plants grown under glass contain as high as 5.5 per cent of potash, while the same crop in the field would probably have contained about one-fourth as much.

As the greatest loss of salts takes place after the plants are dead, there is a logical reason, which has not before been given due weight, for cutting hay and forage just before full ripeness. The harvesting of such crops as sorghum and green corn generally takes place at the period of greatest ash content, and these crops are usually considered to make heavy demands upon the soil. It is quite possible that this exhaustion is due in great part to the removal of the excess of water-soluble salts, which otherwise would be returned to the soil if the plants were allowed to ripen and be subjected to the weathering processes.

The dissolving action of rain also explains in a manner why it so often happens that a large crop for one season is followed by a large crop the following year, especially if during the harvest time of the previous season, or when the plants were nearly ripe, the plants were subjected to heavy rains.

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GENERAL CONCLUSIONS.

The foregoing results clearly show:

(*a*) That on ripening the salts held in the sap of the plants have a tendency to migrate from the dying to the living tissue;

(*b*) That this migration is upward and not downward, there being, in fact, little evidence to show excretion through the roots into the soil;

(*c*) That plants exude salts upon their surfaces, and the rain then washes these salts back to the soil;

(*d*) That the analyses of plants for ash ingredients may give misleading results when it is desired to determine the amount of plant food absorbed by or essential to plant growth, unless the leaching action of rain and dew as herein demonstrated be considered.

INTENSIVE METHODS AND SYSTEMATIC ROTATION OF CROPS IN TOBACCO CULTURE.

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WASTEFULNESS OF EARLY METHODS.

In the tier of States just south of Mason and Dixon's line and the Ohio River and stretching from the Atlantic Ocean to the Mississippi River, particularly including Virginia, Maryland, Kentucky, and areas adjacent to Kentucky in bordering States, the cultivation and exportation of tobacco was the foundation of the agricultural and commercial activities of the early settlers and pioneers. These men found a soil of excellent natural strength and fertility and a country which was generally heavily timbered. Through all the colonial period and even down to the present time it was, to a considerable extent, true that there was a large available supply of cheap and unimproved land. Until quite recently there was also an abundant supply of very cheap labor. With such conditions it was natural that agricultural methods should be extravagant and wasteful of both land and labor.

The method generally followed was to clear fresh or virgin land and crop in tobacco for two or three successive years until the fertility of the soil began to diminish. More fresh land would then be cleared for tobacco and the old land cropped in wheat and corn for a few more years until further depleted, when it would be abandoned as an old field.

Live-stock husbandry, except in a very limited way, was very generally neglected, and, where practiced, the stock was not handled in a way to save much barnyard manure for maintaining the fertility of the fields, while it is only during comparatively recent years that commercial fertilizers have been available to any extent. The loss of actual plant food due to cropping was not, however, the most harmful factor in this system of soil exploitation. Owing to the lack of live stock, soil-binding grasses and humus-yielding crops were but little grown. Stripped of their timber covering, and planted again and again in clean-cultivated crops, like tobacco and corn, the originally fertile fields were rapidly depleted of their life-giving store of humus. Much of the country is more or less broken and rolling,

and after the humus was gone the bare fields were washed, gullied, and broken in a way to cause incalculable and almost irretrievable loss and injury.

Since the settlement of the tobacco-growing area under consideration, much of the cultivable land has been through this round of clearing, depletion, and abandonment one or more times.

PRESENT CONDITIONS.

The section under consideration is the original tobacco-producing district of this country, and, taken together with the contiguous area of North Carolina and South Carolina, continues to-day to produce about five-sixths of the tobacco grown in the United States and practically all of the tobacco known as the export and manufacturing types. That is, the group of States south of Mason and Dixon's line grouped about Virginia, North Carolina, and Kentucky as centers and extending from the Atlantic Ocean to the Mississippi River continues to produce practically all the tobacco grown in this country except the seed-leaf or cigar types.

The tobacco growers of the present generation have as their heritage the fields once fertile but now impoverished by the unconsciously wasteful methods of their ancestors. This method of exploiting the superfluity of fertile land in a new country has generally prevailed in other sections, but its evil effects have been more aggravated here because of the essentially one-crop system of farming and the absence of a live-stock husbandry.

Conditions now, however, are radically changing economically. Both land and timber are rapidly increasing in value, and in place of a plethora of cheap labor farm helpers are now becoming extremely scarce and obtainable only at a greatly advanced wage. This combination of new conditions renders the system of clearing and subsequently abandoning land comparatively unprofitable. Agricultural methods are now in process of adaptation to a new set of economic conditions. In the future a large proportion of the tobacco produced must be grown not upon fresh land but upon old land, and the fundamental present-day problem of the grower is how profitably to restore the depleted fertility of the old fields. The time consumed in cultivating an acre of infertile land is nearly as great as that required for an acre of highly productive land, and it will not pay to employ high-priced labor on soils of low productivity. In restoring the crop-producing power of these soils, undoubtedly the most important step is to increase the humus supply. The diversification of crops, a greatly improved rotation system, an effective live-stock husbandry, and the general introduction of much more intensive methods will constitute the better and more profitable methods of the future.

TOBACCO ADAPTED TO INTENSIVE METHODS.

Compared with the grasses, grains, and most other general farm crops, tobacco may be classed as one of relatively high commercial value. As each unit of increase in production in a high-value crop is worth more, expenditures to increase production will be found relatively more profitable. This may be illustrated as follows:

Suppose that under certain conditions corn without fertilizer yields 25 bushels per acre. Even if intelligently expended, under most conditions it would probably take $25 worth of fertilizer to increase this yield to 50 bushels per acre. With corn at 50 cents per bushel, the fertilizer would cost more than the corn is worth. The higher money-value crop of tobacco, however, shows different results. Take a case in which tobacco without fertilizer would produce 600 pounds per acre. Intelligently expended, an application of fertilizer costing $25 an acre would usually increase the yield to upward of 1,200 pounds to the acre. At 8 cents a pound this 600 pounds increase in production would amply justify the expenditure for fertilizer.

Considering the matter in another light, it is apparent that an increase in the commercial value of any product will warrant an additional expenditure to obtain each increased unit of production. At 6 cents a pound for tobacco, 400 pounds increase in yield will just pay for the use of $24 worth of fertilizer; at 8 cents a pound, it will take but 300 pounds increase to pay the fertilizer bill; at 10 cents, 240 pounds. This illustration, however, is not to be taken as an argument for the use of $25 worth of fertilizer on tobacco or against the use of it on corn.

Generally speaking, then, tobacco, being a high-value crop, justifies a greater expenditure for fertilizer and greater care in soil preparation, cultivation, and handling than do other general farm crops of lower commercial value. It is also true that as tobacco increases or decreases in price so does the profit resulting from fertilization increase or decrease; that is, tobacco at 10 cents a pound is more likely to pay for increased expenditures in production than tobacco at a lower price, and the percentage of profit for the increase in expense is higher at 10 cents than it is at a lower price.

It is also true that tobacco is peculiarly subject to variations in price, owing to differences in quality resulting from the methods employed; and it frequently, in fact usually, happens that better fertilizing, preparation of the soil, cultivation, and handling not only increase the yield, but result in a materially better average price for the crop, conditions of soil, climate, etc., remaining the same. This point is well illustrated by the results obtained in the series of fertilizer experiments with dark tobacco conducted on a variety of soils in the vicinity of Appomattox, in the heart of the dark-tobacco belt of Virginia, and now covering a period of five years. The experiments

were conducted jointly by the Department of Agriculture and the Virginia Agricultural Experiment Station. The results of these experiments showed not only a great increase in yield from the use of increased quantities of properly balanced fertilizers, but showed at the same time that the quality of the tobacco was improved and an increase of 1 to 2 cents per pound was generally secured. Thus there was a gain in both quantity and quality. The soils used for these experiments varied considerably in fertility, but were naturally good tobacco soils, possessing fairly good depth and friability, but in a comparatively low state of fertility, being about on a par with most of the land used for tobacco in the neighborhood.

FERTILIZERS FOR TOBACCO.

The fertilizer experiments show that a soil which will yield, say, 900 pounds of tobacco to the acre from the use of the customary application of 400 pounds of 3–8–3 fertilizer (3 per cent of ammonia, 8 per cent of phosphoric acid, and 3 per cent of potash) costing $5, will generally yield as much as 1,400 pounds by using a much heavier application of a properly balanced fertilizer costing $30 per acre under the same conditions of cultivation, handling, etc. The price obtained for the lower yield was about 7½ cents per pound and that obtained for the larger yield about 9 cents, the 900-pound yield selling for $60 and the 1,400-pound for $126. The difference in cost of fertilizer was $25, and in the case of the larger yield the extra cost of handling, marketing, etc., was about $10 an acre. Deducting this increased expenditure ($35) from the gross proceeds leaves $91 for the highly fertilized acre, a gain in net profit of $31 over that obtained from the poorly fertilized acre, or a gain equal to 90 per cent of the cost of securing the increased profit. The formula for the fertilizer used has been modified slightly each year, that used in 1908 being shown in Plate XXXIV, figure 1. Compared with fertilizers generally used, this contains a very high percentage of ammonia, the analysis showing 7 per cent of ammonia, 8¼ per cent of phosphoric acid, and 3 per cent of actual potash. This furnishes per acre of soil 119 pounds of ammonia (equivalent to 98 pounds of nitrogen), 140 pounds of phosphoric acid, and 50 pounds of actual potash, as against 12 pounds of ammonia, 32 pounds of phosphoric acid, and 12 pounds of actual potash furnished in the 400 pounds of 3–8–3 fertilizer. The best fertilizer furnishes to the soil ammonia equal to the quantity removed from the soil in producing the roots, stalks, and leaves of a 1,500-pound crop, very much more phosphoric acid than is actually removed in such a crop, and about half the potash that a 1,500-pound crop uses.

The extensive series of plat experiments with fertilizer in different sections of the Virginia tobacco-producing area indicate the

general need of liberal applications of phosphoric acid—amounts, in fact, greatly in excess of the quantity actually assimilated by the crop. Experiments conducted by the Kentucky Agricultural Experiment Station in the western or dark-tobacco section of Kentucky show a similar ready response to the application of phosphoric acid. In the experiments conducted on the worn tobacco soils of Virginia there has also been a ready response to liberal applications of ammonia in easily available forms, either organic or inorganic. This, of course, was to be expected, because a run-down soil is usually one depleted of its vegetable matter, or humus, and the humus of the soil is practically the only source of the soil's ammonia supply. On soils in which the humus supply has been well maintained by good handling, especially by the turning under of clover or other leguminous plant growth, the returns from such large applications of ammonia would in all probability have been much less striking. Plate XXXIII and Plate XXXIV, figure 1, show the difference in yield of tobacco from the use of different kinds and amounts of fertilizer. The fertilizer plat experiments in different sections of Virginia varied considerably in the relative returns from phosphates or ammonia when applied separately, sometimes the ammonia and sometimes the phosphoric acid giving relatively better returns; but in every case, with the class of soils experimented on, the results were very materially improved by using both liberally in combination.

Although the tobacco plant's requirements for potash are greater than for either ammonia or phosphates, the experiments on the tobacco soils of Virginia have not shown as good results from the use of potash, indicating that those soils generally are relatively better supplied with available potash. When used alone, potash has not as a rule brought any striking gains over no fertilizer; but when added to a fertilizer already well supplied with phosphates and ammonia it has given profitable results for moderate applications. The experiments also show the relative need for potash to be somewhat greater on the lighter soils. Potash has given favorable results in the experiments with bright yellow tobacco in the light-colored soils of Pittsylvania County, near Chatham, Va., not only in increasing the yield somewhat, but in materially brightening the color of the leaf produced. Phosphoric acid also brightens the color, and it was observed that considerable quantities of ammonia could be used even on bright tobacco, thereby materially increasing the yield, without injuring the color seriously if counterbalanced by correspondingly increased quantities of phosphates and potash.

The necessity for applying fertilizing materials in properly balanced proportions, particularly as they may affect the color and quality, is strikingly brought out in the 1908 Chatham (Va.) fertilizer-plot experiments with the bright flue-cured tobacco. With

this type color and fineness are important considerations. The soil used was very uniform and as with most bright-tobacco soils was very poor in vegetable matter, being even below the average, perhaps, in this regard. The yield on all the plots was probably somewhat below normal, because of the protracted dry weather during the growing season. The yield on the check plots receiving no fertilizer was 300 pounds of tobacco per acre, valued at $21.30. As was to be expected on such a soil, there was a very striking increase in yield where ammonia was applied. Cotton-seed meal analyzing 7½ per cent ammonia, 2 per cent phosphoric acid, and 1 per cent potash was used alone on one plot at the rate of 800 pounds per acre. The small quantities of phosphoric acid and potash contained in the meal had some effect in increasing the yield secured, but the principal effect was undoubtedly due to the large amount of ammonia which it carried. The yield on this plot was 740 pounds per acre, valued at $59.08, approximately 8 cents a pound. The tobacco had good body and oil, but was rather coarse and decidedly dark in color. This would appear to be against the use of cotton-seed meal in this quantity for bright tobacco, but on another plot where this same quantity of meal was used to which was added 600 pounds of 16 per cent acid phosphate, not only was the yield increased to 920 pounds per acre, but the color was materially brightened and the value was $79.06, or about 8.6 cents per pound. On still another plot, where 200 pounds of sulphate of potash (50 per cent potash) was added to these two materials, making a complete fertilizer, the yield was again increased to 1,180 pounds per acre; the color and quality generally was still further improved, and the value went up to $135.41, or approximately 11.5 cents per pound. Thus it appears that the tobacco on the plot receiving only cotton-seed meal was of inferior quality, not because it received too much ammonia absolutely, but rather because it received too much ammonia in proportion to the phosphoric acid and potash used with it.

How far this principle may be carried in offsetting the darkening effects of increased applications of ammonia by increasing sufficiently the quantity of phosphoric acid and potash yet remains to be determined, but in any case it opens up an important field for investigations, especially in connection with the growing of soil-improving crops, as cowpeas and crimson clover, in rotation with bright tobacco. Bright-tobacco growers have not generally considered this good practice, because of its bad effect, if persisted in, on color and quality, but it may be found that this tendency can be offset by decreasing or withholding altogether the ammonia in the fertilizer and increasing the application of phosphoric acid and potash—one or both.

It should of course be noted that an increased expenditure for any item, as, for example, greater cost of fertilizers, increases the chance

FIG. 1.—PLOT OF TOBACCO WHICH RECEIVED NO FERTILIZER.

[Yield, 820 pounds per acre; value, $56.85 per acre.]

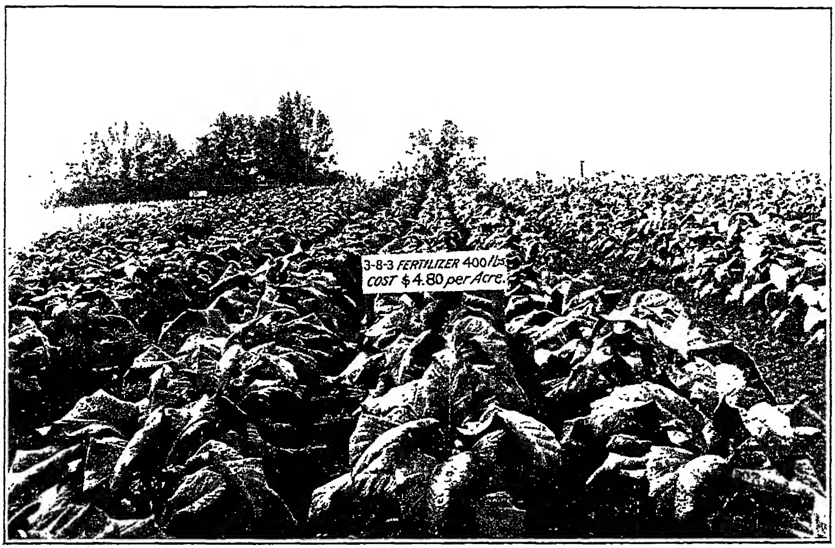

FIG. 2.—PLOT OF TOBACCO WHICH RECEIVED THE CUSTOMARY APPLICATION OF 400 POUNDS OF 3-8-3 FERTILIZER TO THE ACRE.

[Yield, 900 pounds per acre; value, $63.11 per acre.]

FIG. 1.—FIELD OF TOBACCO FERTILIZED WITH A MIXTURE PROPOSED BY THE DEPARTMENT OF AGRICULTURE.

[Yield, 1,880 pounds per acre; value, $157.63 per acre.]

FIG. 2.—A MARYLAND TOBACCO FIELD IN WHICH THE CHANCES FOR A PROFITABLE CROP ARE GREATLY REDUCED BY AN UNEVEN STAND OF PLANTS

[Repeated resettings were made necessary by the attacks of the stalkworm or wireworm.]

of loss in case of failure due to neglect or unfavorable conditions. In the writer's experience, weather conditions are the most negligible factors of probable adverse conditions. Poor crops are much more frequent from any one of several causes than from bad weather. It is an exceptional year when a well-fertilized, seasonably planted, and well-cared-for crop will not come through in good shape in the end; and it is on the infertile, poorly cultivated soils that the bad effects of unfavorable weather conditions are most serious.

Intensive farming presupposes that all the coordinating factors incident to the production of a paying crop shall receive their proper share of attention. In order that deep plowing, thorough preparation, and careful cultivation may pay, the field must be made fertile, a good stand must be secured, and the crop must be planted at the most favorable season; conversely, in order that liberal fertilizing may pay, the field must be so prepared and cultivated that the growing crop can best utilize large amounts of available plant food; and, above all, strenuous efforts should be made to secure a good and uniform stand. The crop should also be planted as close as it can be without injuring its quality. Such experimental data as are available indicate that the yield of tobacco is increased by closer planting up to a certain point, and that the texture of the leaves is finer. Closer planting may thus be taken advantage of to prevent the individual leaves from becoming over-large and coarse, while increasing the total yield per acre at the same time. Higher topping to a certain extent may also be practiced to accomplish the same purpose, although the higher the plant is topped the less uniformity will there be in the leaves from different portions of the plant.

EFFECTS OF CROP ROTATION.

SUPPLY OF HUMUS.

Agriculture is unquestionably greatly aided by commercial fertilizers, and with a high money-value crop like tobacco they can be used in liberal quantities in most cases with very profitable results. Commercial fertilizers, however, are lacking in at least one all-important quality for the permanent upbuilding of the soil. A soil can not remain permanently fertile without maintaining an adequate humus supply. Fertilizers, to have their best effect, must be applied to a mellow loamy soil, rich in decaying organic matter and with good moisture-holding capacity.

The most available, economical, and satisfactory way of building up or maintaining the all-important humus content of the soil is found in the systematic rotation of crops. The rotation should include crops whose cultivation leaves a large residue of roots and stubble. If necessary to maintain the supply of humus a green crop should be turned under occasionally.

WORK OF SOIL BACTERIA.

A fertile soil teems with countless millions of various kinds of micro-organisms constantly active in breaking down and nitrifying organic matter; and, in the chemical recombinations which their activity causes, they have the additional effect of liberating or placing in available form much mineral plant food. Under favorable conditions millions of these organisms are also active in extracting from the air and fixing within the growing plants or soil large quantities of that essential and, when purchased, most costly plant-food element, nitrogen. The numbers and beneficial activities of these organisms are markedly dependent upon the physical condition of the soil. Warmth, moisture, air, and the presence of large quantities of decaying vegetable matter are essential soil conditions for the best activities of these helpful microscopic creatures. The growing of crops in rotation, including, of course, those which increase the soil's humus supply, together with good cultivation, can do more to bring about the most favorable conditions for the beneficial activities of these organisms than any other practical means.

Barnyard manure is, of course, a very desirable and effective means of increasing the fertility, friability, and bacterial efficiency of the soil, but in the tobacco sections under consideration it is not available in sufficient quantities for general use. Indeed, the size of the manure pile depends upon the crop rotation. It is noteworthy that the same crops that furnish a large residue of roots and stubble for building up the soil—the grasses and legumes—also yield in the harvested portion a large quantity of material generally used, and which should be used, on the farm for feeding stock, thus increasing the supply of manure available.

TOXINS IN THE SOIL.

Crops in their growth, it is now believed, have an important toxic reaction upon the soil in which they grow—that is, they give off from their roots during growth matter of a toxic or poisonous nature. Aeration, oxidation, and the chemical recombinations incident to the decay of organic matter are important aids in breaking up and removing these poisonous excretory compounds. Different classes of crops excrete somewhat different kinds of toxic matter. The crops in the rotation should therefore be so arranged as to prevent the toxic effects due to the continuous growing of the same crop.

PLANT DISEASES AND INSECT ENEMIES.

The danger from outbreaks of plant diseases, particularly those which are spread by infection through the soil, is greatly minimized by not growing the same crop or those crops subject to the same dis-

eases too frequently on the same soil. After the soil is once infected with a plant disease from the growing of any crop too persistently, the disease may frequently be completely eradicated by a change to an altogether different kind of crop for one or more years.

Crop rotation can also be made to serve a most useful purpose in many cases by preventing or minimizing the danger from insect enemies,[a] especially those which spend a portion of their life cycle in the soil. Take, for example, the two greatest pests of newly set tobacco, and of many other crops for that matter—cutworms and the so-called "wireworm," or "stalkworm." Their presence depends almost entirely upon the character of the vegetation growing upon the land during the previous season; that is, whether it was attractive or not to the adult forms of these insects during the period when they deposited their eggs. To apply this principle, it is necessary to see that the soil is not occupied at the egg-laying season by vegetation which is attractive to the adult insect or, better still, to see that it is occupied by a form which is altogether repulsive. It is generally known by tobacco growers in many sections that after heavy growths of weeds, particularly the ironweed or stickweed, the soil is very likely to be seriously infested with the dreaded "wireworm;" indeed, it is frequently infested to such an extent as to render it almost impossible to secure a stand of tobacco until the pests leave or pupate, when it is too late to secure anything like a normal crop. A field intended for tobacco, or corn, or any other crop which these pests attack should not be allowed to grow up in ironweed during the previous year. It is the writer's observation, moreover, that a field which has grown cowpeas the previous season, provided they have been kept clean of weeds, will be free from both cutworms and the "wireworm." This fact, if taken advantage of, is of inestimable value to tobacco growers, because the presence of "wireworms" or cutworms in the soil is a most serious drawback to any effort toward the increased use of fertilizers and the adoption of more intensive methods. It is a happy circumstance also for all dark types of tobacco—and these are types grown on soils most likely to be troubled with these pests—that the repellent crop is so desirable and valuable otherwise.

The feeding value of cowpea hay is very great, and the stubble adds much to the fertility of the soil. Increased quantities of ammonia tend to darken tobacco, and in cases where brightness is an important consideration, as in the bright-tobacco belt of southern Virginia, North Carolina, and South Carolina, the cultivation of cowpeas preparatory to tobacco might be objectionable.

[a] A special investigation of the tobacco insects throughout the export-tobacco region is being conducted by the Bureau of Entomology.

Plate XXXIV, figure 2, shows an uneven stand in a Maryland tobacco field due to the attacks of "wireworms." The field was reset several times. With such a stand the prospects for a profitable crop are very poor under any system of culture.

THE EFFECT ON THE SOIL OF CROPS AVAILABLE FOR ROTATION.

The selection of standard crops generally regarded as adapted for cultivation on most tobacco farms in the export and manufacturing districts under consideration may be divided into four main classes: (1) The inter-cultivated crops, corn and tobacco; (2) the small grains, particularly wheat and oats; (3) the grasses, such as redtop and timothy; and (4) the legumes, including the clovers, vetches, and cowpeas.

In producing the inter-cultivated crops—corn and tobacco—the soil should be deeply broken and thoroughly aerated and pulverized. This is highly desirable, but, by hastening nitrification, oxidation, and decay, it serves also to use up the humus supply more rapidly. In the cultivation of the small grains, like wheat and oats, the soil is not so thoroughly and deeply broken and aerated. These crops are not so hard on the humus supply as tobacco and corn, but they are exhaustive rather than recuperative in their effect. The true grasses are similar to the small grains in that their cultivation is not attended with deep breaking and aerating of the soil and their entire plant-food requirements are extracted from the soil itself. There is this marked difference, however, in their effect upon the fertility of the soil: They occupy the soil continuously for two or more years, have a dense root system, and form a good sod, which, when turned under, adds materially to the soil's supply of humus, and during the period of their occupancy they hold the soil against washing and leaching. For these reasons they are to be classed as distinctively soil improvers.

The perennial clovers, such as red, sapling, and alsike clover, in certain respects might best be classed with the true grasses, but they have the additional advantage of being leguminous plants and are able to supply their requirements for ammonia from the air through the aid of the colonies of bacteria living symbiotically in the nodules which they form upon the roots. Their deep taproots also have a valuable effect not produced by the grasses in opening up and aerating the subsoil and in bringing up from the subsoil and utilizing plant-food material not accessible to many other classes of plants. The perennial clovers are often grown with the grasses, and when so grown the combination probably has few superiors in building up the fertility of the soil. The annual legumes, such as cowpeas, crimson

clover, and vetch, also fix atmospheric nitrogen through the aid of bacteria on their roots, and the long taproots have a favorable action similar to the perennial clovers. Some of the annual legumes, like crimson clover and vetch, also occupy the soil only during the cooler months of the year, when they do not interfere with the growing of a regular summer crop. Cowpeas are especially valuable because they will produce a fair crop on a much poorer soil than will some of the other legumes and are a much surer catch under various conditions.

It is noteworthy that the growing of any crop of these four classes reacts upon the soil in a different way from any of the others, and each, except possibly the small grains, serves some particularly desirable purpose in soil improvement not so fully accomplished by any one of the others. It is desirable, therefore, that these different crops be grown in systematic rotation, so that the improving effects of each class may be regularly received and the ill effects of the exhaustive crops be systematically neutralized.

As previously stated, the principal crops grown in the early days were tobacco, corn, and wheat, all exhaustive rather than recuperative crops, and but little attention was given to the grasses and legumes. These early methods finally crystallized under ante-bellum conditions into custom, and it is only in very recent years that attention has been seriously directed to the systematic cultivation of the grasses and legumes in rotation with corn, tobacco, and wheat. It has, indeed, been the custom of many of the best tobacco growers to sow clover seed in their wheat in the spring, and on freshly cleared land a fair stand and growth often resulted. In the larger part of the old tobacco-growing area, however, none of the grasses, clovers, or other leguminous crops have been grown to a sufficient extent or with sufficient success to anywhere near offset the cumulative exhaustive effects of repeated cropping with tobacco, wheat, corn, and oats. The methods employed were so ineffective and the soil was so completely impoverished under the system employed that when attempts were made to grow grasses and clovers the results were generally anything but encouraging. But the case is far from hopeless. Experiments conducted by the writer during the past few years in different sections of the tobacco-producing area, notably in the dark-tobacco district of Virginia, indicate plainly that, with proper adaptation of methods, the soil-improving legumes and grasses can be grown in rotation with tobacco and wheat with most surprising success, and may become such important sources of income, aside from their soil-improving value, as to render the farmer less dependent upon tobacco as the cash crop of the farm.

In placing the cultivation of the soil-improving grasses and clovers upon a successful basis at once the tobacco grower is greatly aided

by the fact that his rotation includes a crop of such high commercial value as tobacco. There are but few general farm crops that will give profitable returns for applications of such large quantities of commercial fertilizers as will tobacco, and the after effects from this heavy fertilization are materially effective in insuring and increasing the success of the wheat, grass, and other crops succeeding the tobacco.

It is not practicable to attempt to lay out a rotation scheme adaptable to all tobacco sections, nor to all tobacco farms within a given section. The soil and climatic conditions of each section will necessitate modifications of any scheme that might be suggested, and the peculiarities of each farm, as well as the individuality of the farmer, will prove additional modifying factors. The important point, however, is that each farmer should study out for himself the best possible rotation for his own farm. So far as possible this rotation should include in systematic sequence all of the standard crops produced; and, under average conditions, the farmer will make a mistake if he does not include in that rotation enough of the soil-improving grass and leguminous crops to furnish a liberal supply of feed for live stock, so as to increase the available supply of barnyard manure and also by the stubble help to maintain the physical condition and bacterial activity of the soil at the maximum state of efficiency. Leguminous crops should be grown also with sufficient regularity to restore so far as possible the nitrogen removed by the nonleguminous crops.

Corn is a gross feeder and under the inadequate system usually followed it has not been considered advisable by farmers to grow corn in the same rotation with tobacco, because it so exhausts the soil as to materially injure the all-important tobacco crop. The result is that, except where there are lowlands or river lands unsuited to tobacco, the corn crop has been relegated generally to the poorer parts of the farm, which are thus made still poorer by continuous corn cropping; or, what is little better, corn is made to alternate with occasional resting years, when the land is given over to weeds and bushes. The result, of course, is a very poor yield of corn. However, with an adequate rotation system, including soil-improving crops, especially the legumes, it would be much better to include the corn in the general rotation unless there is sufficient river land unsuited for tobacco culture to grow all the corn necessary. By placing the corn crop in the general rotation on the better land of the farm the yield secured will necessarily be greatly improved; and, with the introduction of an intensive rotation system, together with a much heavier use of fertilizers on the tobacco, it may be found beneficial even to the tobacco by reducing excessive organic fertility, which would tend to make the tobacco coarse.

In any scheme of rotation proposed for a tobacco farm, the tobacco will probably be regarded as the important money crop of the rotation, and as such may be considered as standing at the head of the proposed rotation.

In connection with the experiment work which the writer has been conducting in Virginia, he has proposed and initiated in an experimental and demonstrative way a rotation scheme, fundamental in its nature, which will bring out the important factors in planning a cropping system in which tobacco is the important crop. The rotation proposed is adapted more particularly to the dark-tobacco district of Virginia, and for other sections it will need modification to make it suitable for the type of tobacco grown and the different soil and climatic conditions.

SUGGESTIONS FOR A ROTATION.

THE TOBACCO CROP.

Heading the rotation as the important money crop stands the tobacco. It should be fertilized very liberally with all the properly balanced fertilizer that the crop will pay a profit on. The results in Virginia go to show that from $20 to $30 worth of such fertilizer per acre can be used to advantage. In the experimental work in Virginia it has been found desirable to set the tobacco somewhat closer than is the custom in order to keep the leaf from becoming overgrown and coarse. The usual distance has been about 3 feet apart in rows that are 3½ feet apart, making about 4,200 plants to the acre. With heavier fertilization it has been found best to set the plants 2½ feet apart in the rows instead of 3 feet, the distance between the rows remaining the same, thus increasing the number of plants to the acre to approximately 5,200. The system of cultivation has also been slightly modified in some respects. The cultivation should be approximately level, except on fields likely to suffer from excess of moisture or standing water, which can be hilled or bedded to advantage in "laying by." Level cultivation is cheapest and best conserves the soil moisture under ordinary conditions.

Cultivation should begin as soon as the plants show signs of growth. The first time over, the double-shovel plow fitted with narrow teeth run three times in a row has been found useful to thoroughly break out the middles after the trampling to which they had been subjected during the setting and resetting. Subsequent cultivations, however, were very shallow and frequent, using a five-tooth cultivator with an 18-inch sweep attachment. This is an extremely effective instrument and leaves the soil fine and mellow on top. The 18-inch blade cuts off all weeds, leaves them on the surface, at each cultivation rolls the soil slightly toward the row, which prevents

water from standing immediately around the plants, and covers and kills small grass and weeds. The cultivation with this implement after the tobacco is well started should be repeated every week or ten days according to conditions until the tobacco is topped and too large to work without breaking the leaves.

Very strenuous efforts have been made in the case of all the experimental crops to plant early rather than late in order to insure a good cure, as it is often very difficult to properly cure late-harvested crops in the cool dry weather likely to be encountered. The damage from the hornworm is also considerably less in early tobacco, the yield is usually larger, and the leaf is more elastic and finer in quality. The only drawback to early planting is the danger of damage from cutworms and "wireworms," which makes an uneven and broken stand. It is essential, therefore, to so arrange the rotation that the crop preceding the tobacco will be unattractive to the adults of these species. As already stated, cowpeas grown free from weeds have been found most satisfactory and valuable for this purpose.

THE WHEAT CROP.

The crop following the tobacco in most sections is wheat. This seems most practicable and desirable and is regarded with favor. In preparing land for wheat, it is the general custom in most parts of Virginia to throw out the tobacco stubble with a 2-horse turning plow. A better way, it is believed, and one that has been followed most successfully in the writer's experimental and demonstration work, is to harrow the field over several times with a disk harrow until it is thoroughly pulverized to a depth of 2 or 3 inches without throwing out the stubble with a plow at all. A better and more uniform surface preparation with a firm subsoil such as is best for wheat seeding is secured by this method. If the tobacco has been heavily fertilized it is not probable that it will pay to use any fertilizer on the wheat. It is important, however, to sow the wheat neither too late nor too early. Experiments by the Virginia Agricultural Experiment Station covering a period of four years go to show that the yield is materially affected by sowing too early or too late. From October 1 to 10 is the best season in most sections of that State.

In experiments at Appomattox, in the Virginia dark-tobacco district, yields have been obtained of from 25 to 30 bushels of wheat per acre after tobacco with heavy fertilization, costing $32 an acre, and of from 12 to 15 bushels per acre on check plats where the tobacco was fertilized with 400 pounds of ordinary 3–8–3 fertilizer, costing $5. No fertilizer was applied directly to the wheat in either case. These yields illustrate in a most striking way the beneficial

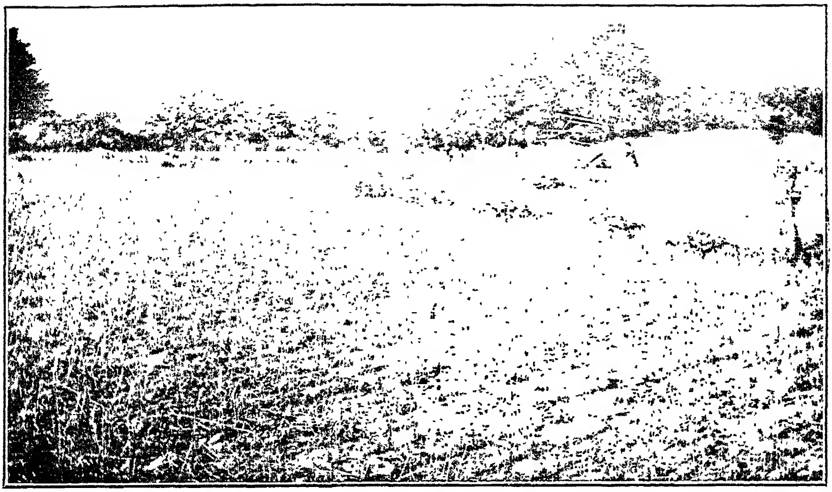

FIG. 1.—FIELD OF WHEAT SUCCEEDING TOBACCO WHICH HAD RECEIVED 400 POUNDS OF FERTILIZER, AS SHOWN IN PLATE XXXIII, FIGURE 2.

[Yield, 12 bushels per acre.]

FIG. 2.—FIELD OF WHEAT SUCCEEDING TOBACCO WHICH HAD BEEN FERTILIZED WITH A MIXTURE, AS SHOWN IN PLATE XXXIV, FIGURE 1.

[Yield, 29 bushels per acre.]

FIG. 1.—FIELD OF GRASS SUCCEEDING WHEAT WHICH FOLLOWED TOBACCO.

[The tobacco had received a heavy application of fertilizer, as shown in Plate XXXIV, figure 1. Grass top-dressed in the spring with 300 pounds of nitrate of soda per acre. Yield, 5.06 tons of field-cured hay per acre.]

FIG. 2.—THE SAME FIELD OF GRASS SHOWN IN FIGURE 1, AFTER IT HAD BEEN CUT AND COCKED.

FIG. 1.—FIELD OF TIMOTHY AT BOWLING GREEN, VA.

[The grass at the right received no nitrate and was hardly worth cutting. That at the left was top-dressed with nitrate at the rate of 300 pounds to the acre, an excellent yield being the result.]

FIG. 2.—VIEW OF SOME OF THE CROP ROTATION PLOTS AT UPPER MARLBORO, MD.

[At the extreme left is land fitted for sowing grass. The cowpeas in the center will be plowed down in the fall and be succeeded by corn the next season. The corn, seen at the right, which has an excellent stand of crimson clover in it, will be succeeded by tobacco heavily fertilized.]

after-effects resulting from liberal applications of fertilizer on the tobacco, and should be regarded as an additional credit against the cost of the tobacco fertilizer. Plate XXXV, figures 1 and 2, strikingly illustrates the benefits to the succeeding wheat crop from the use of an increased quantity of fertilizer on tobacco.

THE HAY CROP.

Grass will most naturally follow the wheat in the rotation, and most encouraging results from the methods pursued have been secured in the Virginia experiments. The custom has been to sow grass, if at all, with the wheat in the autumn, and to sow clover, when that is used, on the wheat land early in the spring. This is a cheap method of seeding, but can not be relied upon to give satisfactory results. After the wheat is harvested, the long, hot summers give the young grass or clover plants a hard struggle for existence, and in any case the field is almost sure to become very weedy during the summer period. The stand of grass secured, furthermore, by this method is not likely to be thick enough to produce a heavy crop, and the hay is almost sure to be full of weeds and bushes. On very rich land, also, sowing the grass with the wheat is almost sure to injure the chances of securing a good wheat crop. On poor land the wheat is not much injured, because the grass makes so little start, but the chances for securing any grass worth cutting on such soil are meager.

To make the growing of grass in the section under consideration fully realize its possibilities, separate preparation of the land and separate sowing of the grass seed in the late summer or early fall, after the removal of the wheat crop, is by far the most promising method. As soon as possible after the cutting of the wheat, the stubble should be disk-harrowed and the surface put into a fine and mellow condition, preferably not to exceed 1 or 2 inches in depth. It should be occasionally reharrowed through the summer when the moisture content is right and then heavily seeded, preferably with mixed grasses, in the late summer—from the middle to the latter part of August. It is important to have only a very shallow surface preparation for sowing grass seed. What is needed is a fine mellow seed bed, with the firm undersoil so near the surface as to bring the moisture up far enough to sprout the seed and keep the young plantlets alive, even in the event of prolonged dry weather immediately after seeding. Unless the soil is known to be very fertile, enough fertilizer should be applied at seeding time to give the grass a good start for the winter. Preparing the seed bed for grass with a disk harrow is much more expensive than sowing the seed with grain, but the chances for a large crop of grass for at least two years are greatly increased thereby,

and, as shown by the Virginia experiments, the increase in the crop is much more than sufficient to pay for the increased cost of preparation. A thick, uniform stand over the entire field is imperative if big yields of grass are to be secured.

Our experiments have given the largest yields from a mixture of 12½ pounds of timothy, 7½ pounds of redtop, and 10 pounds of sapling clover to the acre. In the test of these one year, clover alone gave 2.81 tons, redtop and timothy 4 tons, and a mixture of all three 5.06 tons of field-cured hay per acre. If a good stand is secured it has been found to pay liberally to top-dress the grass very early in the spring, say the latter part of March, when the grass shows signs of starting to grow, with 200 to 300 pounds of nitrate of soda per acre. Top-dressing in this way has been found to increase the yield from 1 to 2 tons per acre. Plate XXXVII, figure 1, shows clearly what a great difference nitrate of soda frequently makes in the yield of grass.

From this system of preparing the land, seeding, and fertilizing following wheat, which in turn had succeeded heavily fertilized tobacco, a yield of first-class hay has been obtained under a considerable variety of soil and seasonal conditions. These results are extremely encouraging, insuring the rapid upbuilding of the soils on which the grass is grown and promising to the growers a source of income of such importance as to render the farmer relatively much less dependent upon tobacco for ready cash. The experiments thus far conducted indicate that grass grown in rotation, with the intensive methods employed, will stand for at least two years, giving practically as heavy a crop of first-class hay the second year as the first. The field in Appomattox which grew 5.06 tons of hay per acre the first year after seeding also produced 3.7 tons per acre the second year, but under seasonable conditions not quite so favorable as in the first year. Plate XXXVI, figures 1 and 2, shows views of this field before and after the cutting of the grass.

THE CORN CROP.

After the grass has stood for two years, having been pastured, perhaps, after the first cutting of the second season, it is recommended that it be plowed under during the fall or winter and followed by corn. On a two-year-old sod that has produced a heavy crop of grass each year an excellent crop of corn should be secured, probably exceeding 50 bushels per acre in most years if it has the benefit of good cultural methods and perhaps a small application of fertilizer.

LEGUMINOUS CROPS.

Taking advantage of every opportunity for working in a soil-improving crop, crimson clover should be sown in the corn at the last working. The chance of securing a good stand and a satisfactory growth during the fall and spring months should be exceedingly good on the fertile soil handled in rotation so intensively. This crimson clover might be harvested or turned under and the field prepared for tobacco, but the great drawback to this course on the stiffer soils is often found in the poor or too late preparation for the tobacco. A dry spell at the proper time for turning under the clover or stubble may cause serious delay or bad preparation or both. It will be much better to delay the tobacco another year and grow a crop of cowpeas after the crimson clover, thus securing the additional benefit to the tobacco from turning under the stubble of the leguminous crop and the invaluable freedom from cutworms and "wireworms" to the newly set tobacco, besides enough pea hay (excellent for cows) to more than pay for the cost of growing the crop. The pea stubble should be plowed under during the fall or winter in order to insure sufficiently early preparation of the soil to take advantage of the best seasonal conditions for the growing and curing of the tobacco.

CHANGES AND ADAPTATIONS.

The suggested rotation covers six years, includes the standard crops of the average tobacco farm, and arranges them in such sequence that the exhaustive crops are interspersed with the soil-improving crops. It can be easily modified in a variety of ways without changing its fundamental features. If it is desired to give wheat a larger place in the rotation it can be done by following the corn with wheat instead of crimson clover. The proportion of corn can be increased by following the crimson clover or the cowpeas with corn and again following the corn with cowpeas in preparation for the tobacco. Plate XXXVII, figure 2, gives a general view of some of the crop-rotation plats at Upper Marlboro, Md., where experiments are conducted cooperatively by the Bureau of Plant Industry and the Maryland Agricultural Experiment Station. The fallowed land on the left is fitted for grass seed. The cowpeas in the center will be followed by corn next year, and tobacco will follow the corn, seen at the right, which contains a good stand of crimson clover. This is such a light soil that satisfactory preparation for the tobacco crop is not likely to be delayed by hard, dry soil, as might be the case on stiffer soils.

SUMMARY OF FEATURES OF THE SUGGESTED ROTATION.

The rotation proposed gives three important sources of money return—the tobacco, the wheat, and the live-stock products from the feeding of the hay and other forage. In only two crops out of the six is any considerable quantity of plant food removed from the farm—the leaf tobacco and the grain of the wheat. Four of the crops out of the six produce stock food in large quantities—the corn, the two grass crops, and the cowpeas, while the straw of the wheat is also of material value for feeding purposes. Three of the six crops are distinctively soil-improving in their nature, replenishing the humus supply and the nitrogen content—the two grass crops, including clover, and the cowpeas.

From the feeding of so much forage a greatly increased supply of barnyard manure should result, sufficient, probably, to manure each field once during the full course of the rotation. It is suggested that this manure be used for top-dressing the second-year grass field during the winter and early spring. This would greatly increase the grass yield and take the place of the nitrate of soda on the second-year grass. When the second-year grass sod is turned under for corn, the manure will continue to have considerable effect in increasing the corn yield.

The tobacco is the only crop of the rotation to which it is proposed that any large quantity of fertilizer shall be applied. As previously suggested, as much fertilizer should be used on the tobacco as it will pay a profit on. The Virginia experiments indicate that on ordinarily good soils in their unimproved condition, from $20 to $30 worth of properly balanced fertilizers can be used to the acre with profit. When the rotation becomes well established, however, and the soil has been materially improved by the growing of the heavy grass and leguminous crops and the use of increased amounts of manure, it may be found that the quantity of fertilizer used on the tobacco can be materially decreased, particularly in respect to the proportion of ammonia which it carries.

USE OF POISONS FOR DESTROYING NOXIOUS MAMMALS.

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WASTE IN THE USE OF POISONS.

Poisons are so extensively used in the United States for the destruction of noxious animals that the commerce in them is enormous. Almost all druggists have a considerable trade in substances intended to rid field, garden, orchard, or buildings of pests that destroy crops or other property. These poisons are sold in three forms—proprietary preparations, raw materials, and preparations mixed by the druggist ready for use.

Whatever the form, the purchaser often pays an excessive price for the poison, and then frequently wastes much because of lack of knowledge of how best to use it. Since in the West the people of a single county sometimes expend $25,000 to $30,000 a year for poisons for destroying rodent pests, and since insecticides and other poisons for the entire country cost many millions of dollars annually, the saving of waste in these items is important. At present fully half the expenditure in the United States for rodent poisons is wasted.

Probably the buyer of proprietary poisons has the greatest cause for complaint. Often 1 or 2 cents' worth of material is retailed at from 25 cents to a dollar. The difference between the cost of the material and the selling price represents the manufacturer's profit and the retailer's commission. Large returns enable proprietors to spend much money in advertising or otherwise exploiting their wares, some of which have no merit. But a man does not always complain of excessive cost if the poison proves efficacious. It is when little or no results follow its use that he considers himself defrauded. In reality he is cheated when he pays an unreasonably large price for the manufactured product, because the raw materials are cheap, and directions for their combination and use are now available.

The formulas for the common insecticides are the result of long-continued experiment by expert entomologists and orchardists. They have become standard by reason of long and successful use, and well-informed farmers are now comparatively safe from the impositions of venders of so-called insecticides. But until recently the destruction of noxious mammals has received less attention from experts than

the destruction of insect pests, and the buyer of poisons for mammals has had to depend upon scattered information or personal experiment.

One of the duties of the Biological Survey is to ascertain by experiment the most effective and economical methods of combating noxious mammals and birds. The present article aims to bring together the best formulas and methods, and thus to enable farmers, ranchmen, and others to save time, labor, and money.

THE PROBLEM OF DESTROYING NOXIOUS MAMMALS.

The destruction of noxious mammals is a more complicated problem than that of insect destruction. The farmer who fights these higher forms deals with instincts and intelligence well adapted to cope with his own in the struggle for existence. It is not enough that he place poisoned food or traps in the way of the creatures he desires to destroy; he must make the baits attractive and allay the natural suspicion of the animals by ridding traps of all suggestion of their real nature. He must know the traits of the animals and take advantage of any habit that will enable him to circumvent and destroy them. With such knowledge and the aid of plain, practical directions for carrying on his offensive operations he can in most cases do far more effective work with poisons than with traps, guns, and similar devices. The usefulness of traps, however, should not be overlooked, especially since they can be employed under conditions which preclude the use of poisons; but when large areas are involved and crops are threatened with immediate ruin, swifter methods are needed. Sometimes also the trap is a useful secondary agent for completing the work after the use of poisons.

OBJECTIONS TO POISONS.

It has been urged against poisons that their use is attended by danger, not only to domestic animals but to human beings; if carelessness attends their handling, this is undoubtedly true. In Great Britain the laying of poisons in the open is forbidden under heavy penalties, and the use of poisons for mammals is restricted to ricks, drains, and other places out of the reach of domestic animals. In this country nearly all the States have statutes regulating the sale of poisons, and several of them forbid the laying of poisoned baits for predatory animals on lands not owned by the person who puts out the poison. A few States require posting of special notices in the neighborhood when poisons are laid for wolves or other wild animals. The poisoning of predatory dogs is prohibited in some States and specifically permitted in a few. In general, it may be stated that in the West, where wolves, ground squirrels, prairie dogs, gophers, and similar pests abound, few laws restricting the use of

poisons exist. It is well, however, for anyone desiring to poison pests to first inform himself thoroughly as to the statutes of his State on the subject.

Another objection that has been urged to the destruction of mammal pests by poisons is that their use is inhuman, entailing much suffering upon the victims. The same objection holds to even greater degree against trapping, shooting, and other methods of taking life.

POISONS IN COMMON USE AGAINST NOXIOUS MAMMALS.

The poisons most commonly used to destroy mammal pests in America are phosphorus, arsenic, and strychnine. Nearly all the proprietary poisons on the market have phosphorus or arsenic as a base. Other substances that have been recommended are barium carbonate, potassium cyanid, corrosive sublimate, nux vomica, cicuta, and common squills.

PHOSPHORUS.

Yellow phosphorus seems to be the poison most used for the destruction of rodents. It is an irritant poison, usually slow, though quite variable in rapidity of action, but eventually destroying the life of any animal that eats it. One-fourth of a grain is a dangerous dose for a person, and in one instance a much smaller quantity proved fatal. Used medicinally, it is given in doses of one one-thousandth to one-thirtieth of a grain. Commercial or yellow phosphorus is usually kept under water in the form of waxy, translucent sticks. It is soluble in 4 parts of carbon bisulphid. Its efficiency as a poison depends on the fineness of division. That prepared and mixed by machinery is usually better than poorly mixed, homemade preparations. The fineness of division is accomplished by first dissolving the phosphorus in carbon bisulphid, after which the solution is mixed with any suitable medium. Phosphorus rat and roach pastes usually contain from 1 to 2 per cent of phosphorus in a medium of flour or meal and glucose. A popular English rat paste has 4 per cent of phosphorus.

There are several serious objections to the use of phosphorus. The first is that its slow, irritant action entails much unnecessary suffering. While the right to take the life of noxious animals is generally conceded, it should be done without needless torture.

The danger to person and clothing in handling yellow phosphorus should be generally known. This substance is kept and cut under water and should not be touched with the hands. A nearly saturated solution in carbon bisulphid has been known to burst into flame while being carried, setting fire to everything which it touched.[a]

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[a] Essence of turpentine is said to be a positive antidote for phosphorus poison and a cure for external burns by this element.

The chief objection to the use of phosphorus is the danger of serious conflagrations. In the West, where phosphorus is extensively used for killing ground squirrels, it has caused fires which destroyed entire fields of ripe wheat and barley and buildings in which prepared phosphorus was stored. Some hazard attends the use even of carefully prepared phosphorus pastes. Experiments with a commercial paste containing 1.6 per cent of phosphorus showed that it could not be ignited either by contact with flame or by friction; but when stirred after a few hours' exposure to the sun, it burst into flame. Another sample of paste, containing less than 1 per cent of phosphorus, was subjected to the same tests but could not be ignited. It was then left out of doors over night, and rain washed out part of the glucose. The residue, dried by exposure to sun and wind, soon charred and burned through the paper on which it lay.

ARSENIC.

The qualities of arsenic as a poison are pretty generally understood. In the form of Paris green or London purple it is widely employed as an insecticide. It is comparatively cheap, but is by no means as deadly as phosphorus or strychnine. The smallest quantity known to have been fatal to a human being is 2.5 grains. Ordinarily 2 grains would be a dangerous dose for an adult; but much larger quantities are known to have been taken by persons who had become arsenic eaters. Farriers often give a horse a dose of 20 grains without bad results. Its action on rodents is exceedingly variable, and there is ample proof that rats after taking small doses frequently become entirely immune to its further effects.

White arsenic is sparingly soluble in water, and the crystallized form is less soluble than the amorphous. Both forms are acid to test paper, and to some extent acidulate food with which they are mixed. Experience seems to prove that the souring of baits is often sufficient to keep rodents from eating them. This circumstance and the uncertainty of results even when baits are eaten are the chief objections to arsenic. As an alternative, when the bitterness of strychnine prevents baits from being eaten, arsenic is a useful poison.

STRYCHNINE.

Strychnine is one of four alkaloids obtained from nux vomica, the seed of a tree known to botanists as *Strychnos nux vomica*. The chief supply comes from the Malabar Coast, India. Strychnine occurs also in the bark of the same tree, and probably in all plants of the genus Strychnos.

The strychnine of commerce consists of the alkaloid in colorless crystals or white powder, and of several salts, chiefly the sulphate and the nitrate, in needle-like crystals or powder. The alkaloid is

very slightly soluble in water alone, but if an acid be added it dissolves readily. It is soluble also in about six parts of chloroform. The two salts named are freely soluble in 50 parts of cold water and in two or three parts of boiling water. On account of its solubility the sulphate is the most convenient for poisoning rodents, and it should always be used in preference to the alkaloid. It is usually slightly cheaper and is equally deadly.

Strychnine is exceedingly bitter, and this bitterness is a partial safeguard against the accidental swallowing of the poison. It acts upon the nervous system of animals, producing tetanus, convulsions, and speedy death. The least dose known to have been fatal to a human being is half a grain, but a quarter of a grain is regarded as a dangerous dose. The medicinal dose is one one-hundredth to one-twentieth of a grain.

The bitterness of strychnine sometimes causes baits to be rejected by animals. To counteract this, sugar is generally used. The same object is sometimes accomplished by mixing powdered strychnine with honey or with its own weight of commercial saccharine. For poisoning rabbits and field mice, which are accustomed to bitter foods, no sweetening is required, and it is probable that the bitterness of strychnine is no obstacle to poisoning certain other rodents.

As a poison for noxious animals strychnine has several advantages over the others commonly in use. It kills quickly, without the long tortures of corrosive poisons. In spite of its bitterness, baits containing it are rejected less often than those containing arsenic. If strychnine is properly labeled and kept from children, it is less dangerous to have on the premises than most other poisons. Should strychnine be accidentally swallowed by an adult, antidotes are usually available, and by prompt action a fatal result may be prevented.[a] Finally, considering both cost and efficiency, strychnine is an economical poison.

COMPARATIVE COST OF STRYCHNINE AND ARSENIC.—The cheapness of arsenic leads many to select it for poisoning noxious mammals. But experiments by the Biological Survey show that strychnine, all things considered, is a cheaper poison than arsenic. Strychnia sulphate may be purchased in bulk at about 75 cents an ounce; white arsenic costs about 15 cents a pound. An ounce of strychnine will

[a] In case of poisoning by strychnine an emetic should be promptly given—a teaspoonful of mustard in a glass of water (warm, if available). Another excellent emetic is zinc sulphate (10 to 60 grains in tepid water) or apomorphine (4 drops by hypodermic injection). A stomach pump can not be used after the first few minutes. As soon as the emetic has acted, the patient should be put slightly under the influence of chloroform or ether, and kept so for several hours. He should be kept in a darkened room and away from noise of all kinds. Further treatment may be left to the physician, who should be summoned as soon as the poisoning is discovered.

thoroughly poison 60 pounds of wheat intended for field mice; a pound of arsenic will poison only 10 or 12 pounds of the grain for the same purpose. The cost of preparing the 60 pounds of wheat, therefore, will be about the same with either poison; but more of that containing arsenic is required to kill. Actual field experiments clearly demonstrated the advantages of strychnine. The baits containing strychnine were eaten freely and many dead mice were found, while on the areas treated with arsenic little of the wheat was eaten and dead mice were few. Experiments show that an ounce of strychnine, if properly distributed, and if none is wasted, is enough to kill 4,500 prairie dogs or large ground squirrels or 9,000 field mice.

OTHER POISONS.

BARIUM CARBONATE.—As sold commercially, this is a dense, heavy white powder, insoluble in water but dissolving in the presence of several of the common acids. It is a rather cheap mineral poison without taste or smell. For this reason it has been recommended for destroying rats and mice. It is poisonous to larger animals when taken in considerable quantities, and in one case of human poisoning 60 grains of the salt proved fatal. Its action is corrosive and very slow.

POTASSIUM CYANID.—This intensely poisonous substance has been employed for destroying prairie dogs in the West, but usually in combination with strychnine. Although cheap, the fact that in contact with the soil and atmosphere it rapidly decomposes and loses its poisonous qualities impairs its usefulness. It has been found too that dogs, when given doses of 2 or 4 grains of potassium cyanid, vomit the poison and recover.

CORROSIVE SUBLIMATE.—Corrosive sublimate, or mercuric chlorid, of commerce occurs in heavy colorless masses, which dissolve in 16 parts of cold water and 3 parts of boiling water. A dose as small as 3 grains has been known to be fatal to man. Its corrosive action on the digestive tract is rapid, and somewhat like that of carbolic acid, but death results usually from exhaustion. Although this poison has often been recommended for rodents, the burning sensation in the mouth and the constriction of the throat it causes preclude its employment.

NUX VOMICA.—The nux vomica of commerce, extensively used in medicine, is largely employed in the Old World for poisoning rodents. It contains from 2 to 5 per cent of poisonous alkaloids, mainly brucine and strychnine, but the proportions of each vary so greatly that the strength of the poison is uncertain, and it is better to use the purer strychnine instead. The baits can then be made of definite strength and the poison economically applied.

CICUTA AND SQUILL.—These two plants have been recommended for destroying rats and mice, and published formularies contain directions for preparing the poisons. The first is *Cicuta virosa* or *C. maculata*, known as water hemlock, a common marsh plant, the roots of which contain a very active poisonous principle known as *cicutoxin*. This produces tetanic convulsions and death in animals. The bulbs of the common squill or sea onion contain *scillitin*, a poisonous glucoside which dissolves in alcohol or ether. This poison is sometimes used in connection with barium carbonate, the squill, it is said, being used chiefly to attract rats or mice to the bait. The writer has not yet tested the efficiency of these poisons.

POISONING WOLVES AND COYOTES.

Passing from the general consideration of poisons to their practical use by the farmer and stockman for the protection of his property against pests, it may be stated that strychnine is the most effective poison known for wolves. The strychnia sulphate is to be preferred on account of its quicker action. The proper dose for a wolf is 4 grains; for a coyote, 2 grains. The common 3-grain gelatin capsules of the drug stores, if well filled, will hold 4 grains of strychnine. The 2-grain capsule should be used for coyotes. Fill, cap, and carefully wipe each capsule to remove every trace of the drug from the outside. Insert it into a piece of beef suet the size of a walnut and close the cavity. The baits should be carried in a can or pail and not handled except with gloved hands or forceps. They should be dropped from horseback along trails followed regularly by wolves or along an artificial trail made by dragging an old bone or piece of hide well saturated with the fetid scent described in Circular 63 of the Biological Survey, which should be consulted for more detailed directions for destroying wolves. These baits are very effective when placed around or partly under a carcass on which wolves or coyotes are feeding.

POISONING PRAIRIE DOGS.

Poison and fumigation with carbon bisulphid are the only means that have proved successful in destroying prairie dogs over large areas. The cost of poisoning is less than half the cost of fumigation. The area should first be gone over with poison and the bulk of the animals thus destroyed. The few that escape may then be located in their burrows and destroyed with carbon bisulphid.

Wheat treated with strychnine has proved an economical and efficient poison, but is objectionable because it kills numerous valuable birds. Rolled grain and meal are less likely to be eaten by

birds, particularly if carefully placed close to the mouths of the burrows. As a medium for conveying the poison there is little doubt that alfalfa, either green or dry, will prove equally or even more successful, and it has the advantage that it is not eaten by birds.

One and a half ounces of strychnia sulphate is enough to prepare a bushel of wheat. Dissolve the strychnine in a quart of boiling water and add a quart or more of thick sugar sirup. Pour this mixture over the wheat in a clean metal vessel and stir until all the wheat is wet. Stir in corn meal to take up any surplus moisture, if the poison is to be used immediately, or add more water and leave the wheat to absorb the strychnine over night. Many experienced persons prefer the latter plan, but the writer has been equally successful with both. About a teaspoonful of the poisoned wheat is placed at the mouth of each occupied burrow. It is important to choose a time when the animals are both active and hungry, preferably in winter or early spring.

THE KANSAS FORMULA.—A few years ago the State of Kansas carried on extensive operations against prairie dogs, destroying them almost completely over nearly 2,000,000 acres of thickly infested land. The poison was prepared at the State agricultural college experiment station, and for more than three years the writer had charge of its preparation and distribution. It was sold to townships and individuals at cost, or the formula for preparing it was given to citizens of the State who asked for it. The formula was adapted from one patented by David W. Staples, formerly of Quanah, Tex.[a] The State purchased the right to use the poison, but the writer found the formula impractical for large operations and it was modified into the following:

For 1 gallon poisoned sirup, use—

4 ounces powdered strychnia sulphate;
4 ounces potassium cyanid;
4 ounces green coffee;
6 ounces alcohol;
4 eggs (whites only);
½ gallon thick sugar sirup.

Preparation.—Mix the coffee and whites of eggs, and let the mixture stand over night. Dissolve the cyanid of potassium in a little less than a quart of hot water, and let it cool before using. Prepare the sugar sirup previously, so that it is not hot when used. Pour the cyanid of potassium solution over the coffee-and-egg mixture, stir, and then strain into the mixing vessel through a sieve fine enough to hold the coffee, which is rejected. Add the sugar sirup and stir thoroughly. Dissolve the strychnia in a little less than a quart of boiling water. Pour the alcohol into this solution and stir. Then add the mixture of strychnine, alcohol, and water to the contents of the mixing vessel and stir thoroughly.

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[a] Patent No. 456602, issued July 28, 1891. Expired July 28, 1908.

The strychnine will be precipitated by the cyanid, and when the poison is placed in a can and allowed to stand will settle at the bottom. The poison should be kept closely corked until used.

A gallon of this poisoned sirup is enough to poison two bushels of wheat. Before it is mixed with the wheat it should be thoroughly stirred or shaken, and a few pounds of corn meal added to make the sirup adhere to the grain. This preparation may be used immediately. Another way is to add more water and leave the wheat over night to absorb the strychnine.

The potassium cyanid in this formula makes the poison a quick killer when first put out. The quantity of strychnine is probably somewhat in excess of actual requirements.

Green alfalfa or alfalfa hay for poisoning prairie dogs should be chopped into short lengths and sprinkled with strychnine water or sirup until thoroughly wet. A large metal washtub should be used as a mixing vessel. An ounce of strychnia sulphate dissolved in a half gallon of water will prepare 30 pounds of green alfalfa; or the same quantity of strychnine dissolved in 3 or 4 gallons of water will prepare 20 pounds of alfalfa hay.

POISONING GROUND SQUIRRELS.

Ground squirrels are a serious pest in many parts of the West. The larger species are usually more difficult to poison than the smaller ones; but as they ordinarily eat more food, the difference in the formulas is less than one might expect. For the smaller ground squirrels, use—

1 ounce strychnia sulphate,
35 pounds clean wheat,
2 gallons water.

Dissolve the strychnine in the water in a large mixing vessel. Then pour in the wheat and allow all to simmer for an hour, the vessel being covered. Stir occasionally. The water will probably be entirely absorbed by the grain, but if not, a little corn meal will take up the extra moisture. If preferred, the strychnine may first be dissolved in a pint of boiling water, the ingredients then mixed in a large vessel, and all left over night to absorb the poison. Distribute the poisoned wheat, a half teaspoonful at a place, at the mouth of the squirrel burrows. Do not scatter broadcast on account of the danger of killing birds.

For the larger ground squirrels reduce the quantity of wheat in the above to 25 pounds and the water in proportion. Experiments in California in destroying the digger ground squirrel (*Citellus beecheyi*) with pieces of sugar beets into which crystals of strychnia sulphate had been inserted with a knife gave good results.

POISONING POCKET GOPHERS.

The several species of pocket gophers in the United States differ considerably, but they are much alike in their destructive habits and are a pest wherever they occur in cultivated lands.

The pocket gophers of the Mississippi Valley and the southern States east of the Mississippi belong to the genus Geomys, and are readily poisoned with strychnine. The writer has had excellent success in destroying them with various baits in the late fall and early winter and reasonably good results at other seasons. Crystals of strychnine may be inserted into pieces of potato, carrot, or sweet potato, or in raisins, and the baits placed in the tunnels several feet from the fresh mounds. If placed in the laterals near the mounds they are likely to be pushed out by the animals in bringing out soil and so not found. An instrument consisting of a spade handle shod with a metal point and having a metal bar for the foot about 15 inches from the point is admirably adapted to making openings into the tunnels into which the baits may be dropped. The holes need not be closed.

With the instrument described it is possible for one man in a day to distribute gopher poison on 30 to 40 acres of badly infested meadow or alfalfa land. A sharp-pointed stick may be substituted for the spade handle, but it can not be operated successfully in any but loose soils.

Corn soaked in strychnine sirup prepared as recommended for poisoning prairie dogs is an excellent bait for pocket gophers. A few kernels are dropped into holes made in runways as described above.

(For methods of trapping gophers, see revised edition of Circular 52 of the Biological Survey, "Directions for Destroying Pocket Gophers," 1908.)

POISONING RABBITS.

Rabbits, especially jack rabbits, are pests in many parts of the West. Winter has proved the best time for poisoning them. In summer the baits are often eaten by grasshoppers, and because of the abundance of green foods, are much less likely to be taken by rabbits.

Pieces of apple, carrot, sweet potato, or melon rind are favorite baits for rabbits. Crystals of strychnia sulphate are inserted in them and they are left along rabbit runs, either on the ground or elevated on short sticks. Artificial runs may be made in orchards with a drag or one-horse scraper. Another excellent bait is oatmeal soaked in a sweetened solution of strychnine. Bran or chop, prepared with arsenic for poisoning grasshoppers, has sometimes proved effective for rabbits.

In winter rabbits may be poisoned with alfalfa hay prepared by the formula for poisoning prairie dogs, or by baiting with twigs cut from apple trees and dipped in a rather thick solution of strychnine and sugar. Both baits have the advantage of not endangering birds, but the poisoned alfalfa should be fed in inclosures from which live stock is excluded. At the same time the rabbits must be carefully fenced away from haystacks, or they may not eat the poisoned bait.

POISONING MEADOW MICE.

The most effective poison for the short-tailed field mice is strychnine. In the recent outbreak of these pests in Nevada, the best baits proved to be alfalfa and crushed wheat.

An ounce of strychnia sulphate dissolved in 5 or 6 gallons of water will effectually prepare 30 pounds of chopped dry alfalfa hay; or, with 1½ gallons of water, will prepare 45 pounds of green alfalfa cut into short lengths. The poisoned food is distributed near or in the mouth of burrows, a small pinch at a place, especially in cold weather, when the animals do not feed in the open. Green alfalfa bait should not be put out when the sun is hot.

In the absence of alfalfa, crushed wheat is an excellent bait. An ounce of strychnia sulphate in 2 gallons of water will poison 60 pounds of crushed wheat. The prepared wheat is distributed in the mouse runs near burrows, very small quantities at a place. No more food than the mice can eat should be put out, especially as the wheat endangers a number of kinds of birds.

Mice in orchards and other places where they occur in normal numbers may be destroyed by feeding the prepared baits under shelters where birds will not find them. Piles of brush, wide boards, old tin cans with the ends crushed inward, and drain pipes have all been recommended as coverings for the poisoned food. Twigs of apple trees poisoned as for rabbits have also given excellent results with field mice without danger to other animals or birds.

POISONING HOUSE RATS AND MICE.

It is usually undesirable to poison rats or mice in occupied dwellings, since, notwithstanding statements to the contrary, no poison is known which when eaten will prevent decomposition of the animal's body. Hence traps are the chief reliance of the householder to keep his home free from these rodents. The more slowly acting poisons have sometimes been recommended as permitting the rats time to leave houses before dying. Barium carbonate most nearly fulfills this requirement, but if rats eat much of the poison they frequently die on the premises. The powder may be spread or sprinkled upon small pieces of buttered bread; or one part by bulk of barium car-

bonate may be mixed with eight parts of rolled oats, and enough water added to wet the mixture and make a thick dough.

For poisoning rats in fields or in places where the lives of domestic animals are not endangered, grain soaked in strychnine sirup is successful. A good plan is to bait the animals for several nights with unpoisoned grain, until they are accustomed to feeding at a particular place. Then feed nothing or very little for a single night, and the next follow with a liberal quantity of poisoned grain.

The common brown rat becomes wary and suspicious with age and experience, and is then difficult to trap or to poison. Care to avoid handling baits or traps and skill in choosing localities and otherwise allaying suspicion are essential to success with old rats. The young are no more difficult to trap or poison than are mice.

POISONING MOLES.

Moles are not vegetarians, but feed almost exclusively on earthworms and insects. They do much good by destroying white grubs, the larvæ of various species of June bugs, or May beetles. They do no harm except to lawns; and the actual injury is slight, except in times of drought, when the grass dies along their tunnels. Rolling is usually a remedy for the injury.

The disrepute attaching to moles as destroyers of crops or plants is due largely to a misapprehension of facts. The pine mouse and other species of meadow mice habitually utilize the mole runs and destroy potatoes and other roots and vegetables, while the innocent mole bears the blame. The mice may be readily killed by placing poisoned grain in the mole runs.

It is claimed that moles may be poisoned by small bits of meat into which strychnine has been inserted, or by earthworms cut and sprinkled with powdered strychnine. Experiments by the writer have given negative results. Experiments with the soft, milky kernels of fresh green sweet corn soaked in strychnine sirup and placed in the mole's tunnels were more successful, several dead moles having been dug out by dogs within short distances of the places where the poison had been inserted.

CAUTION.

All operations with poisons for noxious mammals should be conducted with every safeguard against accidents to persons, domestic animals, and game. Wisely used and carefully handled, poisons need not endanger lives other than those aimed at. Ordinarily, beneficial birds have suffered much from squirrel and prairie-dog poisons, especially in winter. Experience has taught the writer that during poisoning operations on the plains, if unpoisoned grain is scattered freely in the vicinity of watering places, the birds will remain there and few of them will find the poisoned grain intended for the rodents.

INSTRUMENTS FOR MAKING WEATHER OBSERVATIONS ON THE FARM.

By Dewey A. Seeley,

Observer, Weather Bureau.

From seed time to harvest the tiller of the soil is continually dependent upon the weather. If there is not sufficient warmth and sunshine in the spring the seed bed remains frozen, and prolonged rains or drought may also prevent its preparation. There is little use of sowing the seed unless the soil is in the right state as regards warmth and moisture to start the process of germination, as the germ in the seed will decay if the ground is too wet and cold, or will dry up and die under the effects of a parching sun.

After growth has begun, the development of the plant is largely a matter of adequate water supply and heat, granted that the soil is fertile and properly cultivated. Careful experiments have shown that a water supply of about 300 pounds is required for the production of 1 pound of corn. This amount of water must be carried up through the roots of the corn plant, distributed through its cell structure, and evaporated through its surface of stalk and leaves, in order that 1 pound of corn may grow and ripen. With but half the required water supply needed for complete development, the plant will reach only half its normal size and weight. If the weather is cold and cloudy, a plant can not grow normally. It is true that some forms of vegetation survive the temperature of the frigid zone, but it is equally well known that the growth there is stunted and sickly compared with that found in temperate and tropical regions.

Realizing his dependence upon weather conditions, the farmer or gardener should know what warmth of soil is necessary to start germination and the amount of heat and moisture required later to bring the crop to successful maturity. Beginning with this knowledge, the need of actual observations through the use of accurate instruments follows in natural sequence, that he may be able to determine how nearly the weather conditions experienced are measuring up to the ideal. Careful records of this character will be found most interesting, and their value will undoubtedly increase as the facts thus gathered accumulate from year to year.

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Such records can not be made, however, without the aid of good instruments, since the senses are more or less unreliable as weather recorders. Even out-of-door workers are often misled regarding the temperature of the air or the amount of rainfall during a shower. Some days seem warm when the thermometer reads comparatively low, and others cool although the temperature may be much higher. The thermometer alone can be depended upon to give the true temperature, and a properly exposed rain gauge is the best indicator of the amount of rain or snow that falls at any time.

Decided benefits will also be derived at times if, through the aid of other instruments, coming weather changes can be foreseen. An afternoon shower has often seriously damaged a crop of hay that was mowed in the morning, but which could have been left standing another day without injury had the rain been expected. At critical times the knowledge that a frost is imminent on a coming night may enable a farmer or gardener to save his entire crop by immediate harvesting, if it has reached maturity, or, if not yet fully matured, he is often able to reduce his loss to a minimum by burning smudges or resorting to other protective measures.

Meteorological instruments useful to farmers and gardeners may thus be divided into two classes: (1) Those that simply indicate existing conditions, and (2) those that may be used in forecasting the coming weather.

THERMOMETER.

Under the first head the common thermometer is probably the most important. An ordinary form of thermometer is illustrated in Plate XXXVIII, figure 1.

This instrument is in more general use than any other weather indicator. Its value depends largely upon the accuracy of the instrument itself, but also upon its proper exposure. While some inexpensive thermometers are fairly accurate, the majority are incorrect to the extent of several degrees. Among a number of cheap thermometers the readings will usually show considerable variation. If a purchase is made from such an assortment, it would be advisable to note what seems to be the average indicated temperature, and then select one giving such temperature.

Having secured the thermometer, whether cheap or expensive, it would be well to have it compared with those in use at a Weather Bureau office, if possible, as Weather Bureau instruments are always carefully tested before being issued. Such a comparison will disclose to what extent the thermometer is in error, and will enable a proper correction to be applied to each reading in case the instrument is far from being accurate.

No matter how good a thermometer may be, it will not indicate the true temperature of the air unless it is properly exposed. The variations in temperature reported by neighbors in discussing how cold or how warm it was at a given time are more frequently due to lack of uniformity in the exposure of the instruments than to errors in the instruments themselves or to actual differences in temperature at the various locations.

In a proper exposure the thermometer should be protected from the direct rays of the sun as well as from the reflected heat of pavements, walls, etc., and at the same time should receive a free circulation of air all around it. If the sun shines upon the thermometer, the glass portions and the mercury are heated above the temperature of the surrounding air. In the same way the heat from the side of a building or from the surface of the ground may make the thermometer warmer than the free air.

The best place to expose a thermometer is in the center of a slat-sided box, 2 or 3 feet on a side, with a door opening to the north, and having a double roof with an air space between. Such a thermometer shelter is illustrated in figure 20.

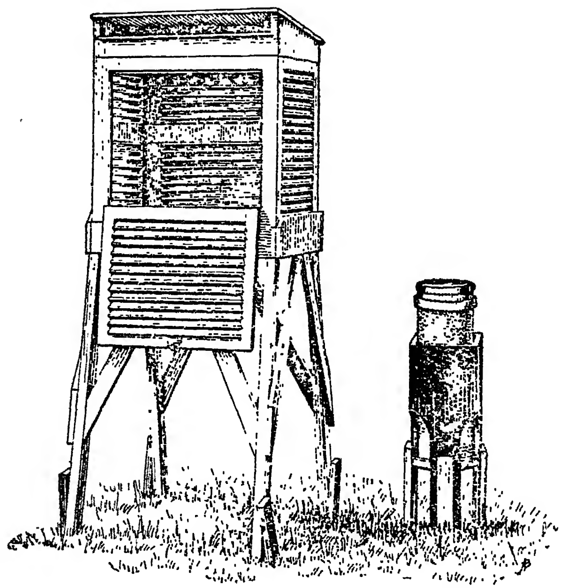


FIG. 20.—Instrument shelter and rain gauge.

In case such a shelter can not be secured or constructed, the next best exposure is on the north wall of a building where the instrument will be protected as much as possible from the sun's rays and from the heat of surrounding objects.

RAIN GAUGE.

Another instrument used in recording meteorological conditions is the rain gauge. Any cylindrical vessel exposed in an open space, where surrounding trees or buildings are far enough away not to stop the rain, will indicate the amount of rainfall. An ordinary tin can with straight sides will serve the purpose, if the top be

entirely removed. It is obvious that the depth of water collected in a vessel having flaring sides would not represent the actual rainfall; and it is also evident that the correct catch would not be obtained, even with a good gauge, if it were placed under the eaves of a building or near a wall or tree which would shelter it. The rainfall is measured regularly, morning and evening, by inserting a rule and observing how high the rule is wetted. The ordinary rule, marked off in eighths and sixteenths of an inch, may be used; but in order to compare the results with the records of the Weather Bureau it is well to use a rule marked off in tenths of an inch.

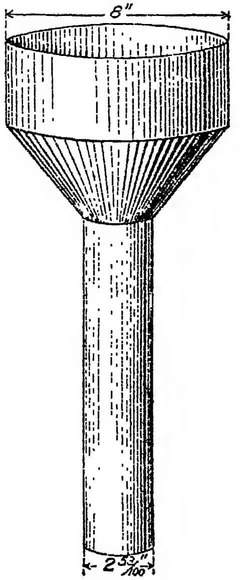
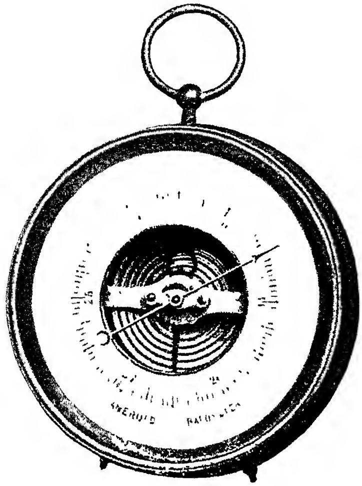


FIG. 21.—Rain gauge, with measuring tube attached.

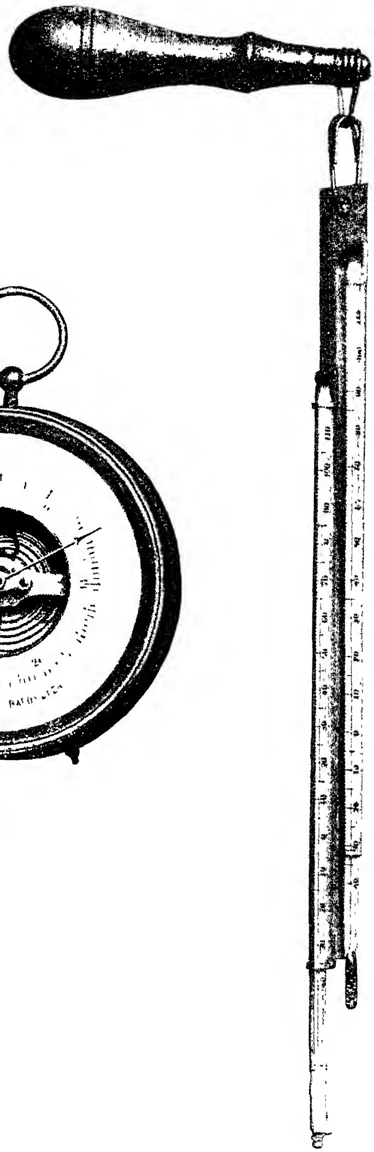
Such a simple rain gauge has this objection, that the rainfall in any one day is frequently so small that it can not be measured with much accuracy. To obviate this difficulty, the receiving vessel may be made with a funnel-shaped bottom, to which is attached, below, a tube with an opening whose area is one-tenth that of the receiving vessel. A rainfall which would measure 1 inch in the upper vessel will then measure 10 inches in this measuring tube; the readings can therefore be more accurately made. The readings taken from the measuring tube must of course be divided by 10, in order to get the actual rainfall. A diagram showing the form of such a gauge with measuring tube attached is given in figure 21. In the standard rain gauge the upper cylinder has an inside diameter of 8 inches, while the diameter of the measuring tube is 2.53 inches. The Weather Bureau rain gauge is shown in position in figure 20, to the right of the thermometer shelter.

Keeping a rainfall record is one of the most interesting tasks that a farmer or gardener can undertake. By adding the depth of each rainfall to the combined depths of those preceding he may find just what the season's supply has been, and by noting the condition of a given crop from time to time he may be able to form an idea as to how it has been affected by the moisture received. Furthermore, the preservation of these records will enable him to compare the rainfall and crop conditions for any one season with those for other seasons.

1



2



3

INSTRUMENTS USEFUL IN OBSERVING ATMOSPHERIC CONDITIONS.

[Fig. 1.—Thermometer, which measures temperature. Fig. 2.—Aneroid barometer, which measures pressure. Fig. 3.—Sling psychrometer, which measures relative humidity.]

ANEROID BAROMETER.

Under the head of instruments used as indicators of coming weather changes, the aneroid barometer, a type of which is shown in Plate XXXVIII, figure 2, probably takes the leading place. This instrument records the variations in the pressure of the air, and as these variations, when pronounced, are usually precursors of a change in weather conditions, its value as an indicator of approaching storms, cold waves, etc., is evident. The essential parts of the instrument are, first, a metal box from which the air has been largely exhausted, having an elastic top susceptible to the varying air pressure it sustains; second, a needle so connected with this elastic top that it will respond to and magnify the movements of the latter; and third, a dial graduated to inches and fractions of an inch so as to correspond to the markings on a mercurial barometer. To adjust an aneroid barometer properly, place it alongside a standard aneroid barometer and bring the needle to the same reading by means of a set screw provided for that purpose.

The words "Stormy," "Clearing," "Fair," etc., which often appear on the face of these instruments are in the main misleading and not to be depended upon. The important thing to notice is the change that is taking place; that is, whether the pressure is increasing or diminishing, and how rapidly.

To make clear why these changes in the pressure aid in foretelling coming weather conditions, it will be necessary to state briefly the principle upon which the United States Weather Bureau forecasts are made in so far as the matter of the distribution of atmospheric pressure is concerned, this feature, in fact, being the most important of the many factors considered. Observations of air pressure, as well as of temperature, rainfall, wind, and cloudiness, are made at more than two hundred regular Weather Bureau observing stations each morning and evening and the data are immediately telegraphed to central forecasting stations, where they are charted on maps of the United States. It is always found that the air pressure is comparatively low over some portions of the country and comparatively high over other portions. These areas of high and low pressure, each usually covering several States, move across the continent in a general west-to-east direction, like great atmospheric waves, the crests of which are designated on the weather chart by the word "high" and the troughs by the word "low." The "lows" are called storm areas, because they are usually attended by rain or snow and high winds, while the advance of the "highs" is marked by clearing weather. The air in the "low," being lighter, is forced upward by the surrounding heavier air, so that there is a constant inflow of air

toward the storm area. The winds do not blow directly toward the storm center, but are slightly deflected toward the right by the earth's motion, the result being a spiral-like movement of the air currents. As the "low" area, or cyclone, as it is termed on account of this spiral motion, approaches a given place the barometer falls, and the winds are southerly or easterly, causing a rise in temperature. As the center of the "low" area passes, the crest of the atmospheric wave, or "high" area, approaches, the winds shift to north and northwest, and the weather clears and becomes cooler, the barometer in the meantime rising steadily.

The following indications, printed on each weather map sent out by the Weather Bureau, summarize the characteristic atmospheric changes and movements in such manner as to permit their practical application to observations made locally:

When the wind sets in from points between south and southeast and the barometer falls steadily a storm is approaching from the west or northwest, and its center will pass near or north of the observer within twelve to twenty-four hours, with wind shifting to northwest by way of southwest and west. When the wind sets in from points between east and northeast and the barometer falls steadily a storm is approaching from the south or southwest, and its center will pass near or to the south or east of the observer within twelve to twenty-four hours, with wind shifting to northwest by way of north. The rapidity of the storm's approach and its intensity will be indicated by the rate and the amount of the fall in the barometer.

The Weather Bureau has published a wind-barometer table, by means of which, if we note the action of the barometer and at the same time observe the direction from which the wind is blowing, we may estimate what kind of weather will probably follow.

This table, which follows, calls for the barometric reading "reduced to sea level." Since the reading of the barometer depends upon the pressure or weight of the air above it, it is apparent that it will read lower on top of a mountain than in a valley and lower on a tableland than at sea level. It has been found that to reduce a barometer reading to what it would have read at sea level we must add approximately one-tenth of an inch for each 100 feet of elevation above sea level. Accurate tables for making this reduction are published by the Weather Bureau. In every case, of course, the observer must know how high above sea level he is.

Wind-barometer table.

Direction from which the wind is blowing.	Barometer reading reduced to sea level.	Character of weather indicated.
SW. to NW.	30.1 to 30.2 and steady........	Fair, with slight temperature changes, for 1 to 2 days.
SW. to NW.	30.1 to 30.2 and rising rapidly.	Fair, followed within 2 days by rain.
SW. to NW.	30.1 to 30.2 and falling slowly.	Warmer, with rain within 24 to 36 hours.
SW. to NW.	30.1 to 30.2 and falling rapidly.	Warmer, with ain within 18 to 24 hours.
SW. to NW.	30.2 and above and stationary.	Continued fair, with no decided temperature change.
SW. to NW.	30.2 and above and falling slowly.	Slowly rising temperature and fair for 2 days.
S. to SE....	30.1 to 30.2 and falling slowly.	Rain within 24 hours.
S. to SE....	30.1 to 30.2 and falling rapidly.	Wind increasing in force, with rain within 12 to 24 hours.
SE. to NE..	30.1 to 30.2 and falling slowly.	Rain in 12 to 18 hours.
SE. to NE..	30.1 to 30.2 and falling rapidly.	Increasing wind, and rain within 12 hours.
E. to NE...	30.1 and above and falling slowly.	In summer, with light winds, rain may not fall for several days. In winter, rain within 24 hours.
E. to NE...	30.1 and above and falling rapidly.	In summer, rain probable within 12 to 24 hours. In winter, rain or snow, with increasing winds, will often set in when the barometer begins to fall and the wind sets in from the NE.
SE. to NE..	30.0 or below and falling slowly.	Rain will continue 1 to 2 days.
SE. to NE..	30.0 or below and falling rapidly.	Rain, with high wind, followed within 36 hours by clearing, and in winter by colder.
S. to SW...	30.0 or below and rising slowly.	Clearing within a few hours, and fair for several days.
S. to E.....	29.8 or below and falling rapidly.	Severe storm imminent, followed within 24 hours by clearing, and in winter by colder.
E. to N.....	29.8 or below and falling rapidly.	Severe northeast gale and heavy precipitation; in winter, heavy snow, followed by a cold wave.
Going to W.	29.8 or below and rising rapidly.	Clearing and colder.

As a rule, winds from the east quadrants and falling barometer indicate foul weather, and winds shifting to the west quadrants indicate clearing and fair weather.

SLING PSYCHROMETER, OR INDICATOR OF MOISTURE IN THE AIR.

Another forecasting instrument is termed a psychrometer. The sling psychrometer consists of two thermometers attached to a handle in such manner that they may be whirled rapidly. The bulb of one of the thermometers is covered with a small muslin sack fitting snugly to the glass, the bulb of the other thermometer being left uncovered. The cloth-covered bulb is moistened in water and the two thermometers are whirled through the air. Evaporation begins at once on the moistened bulb, withdrawing the heat from the contents of the bulb and reducing the thermometer reading, the amount of such cooling being dependent upon the rapidity of evaporation, which in turn depends upon the amount of moisture already in the air. If the air is damp and cold there will be but very little drying of the cloth surrounding the thermometer bulb, with a very slight

difference between the readings of the two thermometers; but on a dry and warm day the water will evaporate rapidly and cause a difference of possibly 10° or 20° between the readings. (Pl. XXXVIII, fig. 3.)

This instrument, then, is an indicator of the amount of moisture in the atmosphere, a condition that has an important bearing in connection with the occurrence of frosts or freezing temperatures, because, when dew or frost forms, heat is given off, and the heat thus liberated naturally tends to retard further cooling of the air. When there is much moisture in the atmosphere, the "dew-point," or temperature at which dew begins to be deposited, is higher than in very dry air. If, therefore, it is found upon making an observation with the wet-bulb and dry-bulb thermometers that the temperature of the dew-point is 10° or more above 32°, there need be little fear of frost within the next twelve or eighteen hours, since observations have shown that the temperature on any night seldom falls more than 10° below the dew-point as determined in the afternoon before.

The temperature of the dew-point, however, is not a safe criterion of the probable occurrence of frosts over marshy places, such as cranberry beds, or in regions where there is a marked flow of air during the night from the cold hilltops to the valleys below. Also, it should be ascertained from the wind-barometer table whether there is a probability of clear skies, of wind, or of a marked fall in temperature during the coming night. Frosts are most likely to occur when the sky is clear and there is no wind, but a high wind may be accompanied by a sufficient fall in temperature to cause frost.

In the accompanying table are given dew-point temperatures corresponding to readings of the dry-bulb thermometer ranging from 35° to 70°, with differences between the readings of the wet-bulb and dry-bulb thermometers ranging from 1° to 15°. For example, if in the afternoon the reading of the dry-bulb thermometer is 48° and the reading of the wet-bulb thermometer is 40°, giving a difference of 8°, the corresponding dew-point temperature is found from the table to be 30°. Again, with a dry-bulb temperature of 61° and a wet-bulb temperature of 48°, giving a difference of 13°, the dew-point temperature is found to be 34°. In both these cases frosts would be expected during the night.

Table for determining the temperature of dew-point in degrees Fahrenheit.

Dry-bulb thermometer.	Dew-point temperature when the difference between the wet-bulb and dry-bulb thermometers is—														
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
35	33	30	28	25	22	18	14	8	1	−8	−28	......	......	......	......
36	34	31	29	26	23	20	15	11	4	−4	−19	......	......	......	......
37	35	32	30	27	24	21	17	13	7	−1	−12	−44	......	......	......
38	36	33	31	28	26	23	19	14	9	3	−7	−25	......	......	......
39	37	34	32	29	27	24	21	16	12	6	−3	−16	......	......	......
40	38	35	33	31	28	25	22	18	14	8	1	−10	−35	......	......
41	39	37	34	32	29	26	23	20	16	11	4	−5	−21	......	......
42	40	38	35	33	30	28	25	21	17	13	7	−1	−13	−59	......
43	41	39	36	24	31	29	26	23	19	15	10	3	−7	−28	......
44	42	40	38	35	32	30	27	24	21	17	12	6	−2	−17	......
45	43	41	39	36	34	31	29	26	22	19	14	8	2	−9	−37
46	44	42	40	37	35	32	30	27	24	20	16	11	5	−4	−20
47	45	43	41	39	36	34	31	28	25	22	18	13	8	0	−12
48	46	44	42	40	37	35	32	30	27	23	20	15	10	4	−6
49	47	45	43	41	39	36	34	31	28	25	21	17	13	7	−2
50	48	46	44	42	40	37	35	32	29	27	23	19	15	9	2
51	49	47	45	43	41	39	36	34	31	28	25	21	17	12	6
52	50	48	46	44	42	40	37	35	32	29	26	23	19	14	9
53	51	49	47	45	43	41	39	36	34	31	28	24	21	16	11
54	52	50	49	47	44	42	40	38	35	32	29	26	23	19	14
55	53	52	50	48	46	43	41	39	36	34	31	28	24	21	16
56	54	53	51	49	47	45	43	40	38	35	32	29	26	23	19
57	55	54	52	50	48	46	44	42	39	36	34	31	28	24	21
58	56	55	53	51	49	47	45	43	40	38	35	32	29	26	22
59	57	56	54	52	50	48	46	44	42	39	37	34	31	28	24
60	58	57	55	53	51	49	47	45	43	41	38	35	32	29	26
61	59	58	56	54	52	51	49	46	44	42	39	37	34	31	28
62	60	59	57	55	54	52	50	48	46	43	41	38	35	32	30
63	61	60	58	56	55	53	51	49	47	45	42	40	37	34	31
64	62	61	59	58	56	54	52	50	48	46	44	41	38	36	33
65	63	62	60	59	57	55	53	51	49	47	45	43	40	37	34
66	64	63	61	60	58	56	54	53	51	48	46	44	42	39	36
67	65	64	62	61	59	57	56	54	52	50	48	45	43	40	38
68	67	65	63	62	60	58	57	55	53	51	49	47	44	42	39
69	68	66	64	63	61	60	58	56	54	52	50	48	46	43	41
70	69	67	66	64	62	61	59	57	55	53	51	49	47	45	42

PRICES OF HIGH-GRADE INSTRUMENTS.

The following prices for reliable instruments have been obtained from the catalogues of various manufacturers:

Mercurial thermometer	\$2.25
Sling psychrometer	5.00
Rain gauge	8.25
Aneroid barometer	18.50

These are list prices for high-grade instruments such as the Weather Bureau uses. It is especially desirable that the psychrometer and the aneroid barometer be first-class instruments. With care in selecting, a reliable thermometer may perhaps be obtained without paying the highest price. The expense of the rain gauge may, of course, be eliminated entirely by using a tin can, or the better pattern of rain gauge may be made of tin or galvanized material at low cost.

BY-PRODUCTS OF THE SUGAR BEET AND THEIR USES.

By C. O. Townsend,

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INTRODUCTION.

The primary object in growing sugar beets is the production of refined sugar. Any other materials, therefore, that remain or are produced in the manufacture of refined sugar from beets should be classed as by-products. These consist chiefly of beet tops (leaves and crowns), pulp, waste molasses, and lime cake. From these original by-products other by-products are often made that are of much greater commercial value than are the original by-products; for example, alcohol made from waste molasses and commercial fertilizer made from refuse slop. The first mill for the utilization of sugar beets, built more than one hundred years ago, made alcohol as one of the chief products, while sugar was looked upon as a by-product or at least as a product of secondary importance. In recent years both the quantity and the quality of sugar produced from beets have placed the material in the highest rank as a commercial product. The total quantity of sugar produced annually from beets is approximately the same as that produced from cane, whether considered from the standpoint of sugar production in the United States or from the standpoint of the world's output, and the sugar is just as satisfactory for all purposes, including the preparation of jellies, jams, and preserves, so far as the Department of Agriculture and several of the State experiment stations have been able to determine.

A careful consideration of the present uses in general of the by-products of the sugar beet brings one to the conclusion that much of their real value is being lost to the farmer and to the sugar company. This paper is written with the hope that a more general interest may be taken in the proper utilization of the sugar beet, and especially of the by-products.

TOPS.

The first by-product of the sugar beet is the tops, composed of leaves and crowns, which are removed by the grower in preparing the beets for the factory at harvest time. Although the sugar is made in the leaves, only a small percentage remains in them, as it is con-

stantly passing into the root, where it is stored. The crown also contains a comparatively small quantity of sugar, while both leaves and crowns contain a comparatively high percentage of mineral matter, or ash. The percentage of ash in the leaves is usually about three times as great as the percentage in the untopped beet, while the percentage of ash in the crown is more than six times as great as the percentage in the whole beet. On account of the low sugar content and the high percentage of ash in the leaves and crowns they are discarded so far as sugar making is concerned, and therefore become a secondary product or by-product.

The leaves and crowns may be utilized either as a fertilizer or as a stock food. As a fertilizer they may be plowed under in the fall while still green or they may remain on the ground and be plowed under in the spring after more or less decomposition has taken place, or when fed to stock they may enter into and form a part of the stable manure, and in this manner be returned to the soil. If left in the field and plowed under, they will add a small amount of humus to the soil and a comparatively large amount of mineral matter. They should therefore be spread over the ground as uniformly as possible if they are to be plowed under.

The weight of leaves and crowns produced per acre varies greatly in different parts of the country, as well as from season to season, depending upon soil and climatic conditions. An average of 4 tons of tops per acre is a conservative estimate. This means an annual yield of about 1½ million tons of this by-product. Of this quantity about one-fourth, or 1 ton per acre, is crowns and the remaining 3 tons per acre are leaves. The crowns contain about 5.6 per cent of mineral matter, or ash, which is equal to about 112 pounds per acre, while the leaves contain about 2.2 per cent of ash, yielding for the 6,000 pounds about 132 pounds of mineral matter per acre. Crowns and leaves together give a total average yield of 244 pounds of mineral matter per acre. This mineral matter consists for the most part of potash, soda, lime, magnesia, chlorin, sulphuric acid, silica, and phosphoric acid, which are mainly necessary plant foods, so that the value of this by-product as a fertilizer should not be overlooked.

If the leaves and crowns are to be fed to stock, they may be utilized in the fresh state, dried, or siloed. The best method of disposing of this by-product must depend upon local conditions and upon the object sought; that is, whether it is advisable to get the most out of this material from the feeding standpoint or to get it into the form of a fertilizer as soon as possible.

Many beet growers turn their sheep or other stock into the beet fields after the roots have been hauled to the factory. This is the

most wasteful method of feeding beet tops, since much of the material is trampled upon and the stock will not eat it. One of the most satisfactory methods of feeding beet leaves and tops is to dry them. This requires extra labor, and if they are artificially dried special machinery is required, which means additional cost. Tops when fresh contain from 85 to 90 per cent of water and when dried from 10 to 12 per cent; that is, in drying there is a loss of about 75 per cent of the original weight of the material, so that the average yield of dried material per acre is about 1 ton, which is considered equal in feeding value to the same quantity of first-class hay. A very small part of this by-product is treated in this manner in this country at present. The cash value of the material as a stock food depends upon the demand and therefore varies with the section and the season.

In some localities, especially in dairy sections, beet tops are siloed with other material for winter and early spring feeding. These silos are filled with alternate layers of beet leaves and some dry material, like straw, which will take up the excess moisture from the leaves. The layers of leaves are, or should be, sprinkled with salt, using about 6 to 8 pounds per ton of leaves. This mixture, if properly siloed, will keep for several years and is considered very satisfactory by dairymen.

Estimating the value of beet tops as $6 per acre, which is at the rate of $1.50 per ton for the fresh material or $6 per ton for it when dried, the total value of this by-product in the United States exceeds $2,000,000. It is evident, therefore, that beet tops have not received the attention due them, either as a fertilizer or as a stock food.

PULP.

The material that remains after the beets have been sliced and the sugar has been extracted is known as pulp. Fresh pulp constitutes about 80 per cent of the weight of the beets. In the process of extraction the beets lose nearly all their sugar, usually only a fraction of 1 per cent being left in the residue or pulp. They also lose a large part of the salts taken up in the process of growth, so that the residue after extraction consists of about 90 per cent water, from 1.5 to 3.5 per cent cellulose, a fraction of 1 per cent each of albuminoids and ash, and about 0.5 to 3.33 per cent extractive substances.

The crop of beets harvested in the United States in 1907 amounted to 3,767,871 tons, which yielded more than 2½ million tons of pulp. This material is disposed of in various ways by the different sugar companies. In some instances it is furnished the beet grower gratis, while in other cases it is sold at a nominal price, from 12½ cents to $1 per ton. At an average price of 50 cents per ton this by-product would represent a return to the sugar companies of more than 1¼

million dollars. Its real value as a stock food has been estimated at from two to three times that amount, depending upon the kind of stock to which it is fed and the object sought; that is, increase in weight, energy, milk flow, butter production, etc.

Efforts have been made to utilize beet pulp in the manufacture of paper and also as a fertilizer. It seems to have a percentage of fiber too low to make it satisfactory in the manufacture of paper. As a fertilizer, it is useful in adding a certain amount of humus to the soil, thereby improving its physical condition. It contains also a small proportion of ash, a fraction of 1 per cent of the wet pulp, which amounts to considerable in the aggregate. Up to the present time its greatest use has been as a stock food. For this purpose it is fed either wet or dried. To be fed in the wet condition, it may be used as soon as it comes from the factory, or it may be left for some time in the factory silo or pit, or the stockman using it may haul it to his farm or ranch and pile it in some convenient place for feeding purposes. The layer of the pulp on the surface of the pile—that is, the part exposed to the air—undergoes certain fermentation changes and should be discarded; for this reason the pulp should be kept in piles as large as practicable, since the larger the diameter of the pile—that is, the greater the bulk of material—the smaller the proportionate loss from surface fermentation. To be fed in the dried condition, it may be dried by itself or it may be mixed with molasses or other edible material before drying. But whether it is to be fed in the wet or in the dried condition it should be mixed with other material before feeding.

It is customary in this country and in Europe to feed the pulp mixed with a given amount of grain or oil cake, together with a quantity of chopped hay, straw, dried beet leaves, or material of a similar nature, the proportion of pulp to other material depending upon the object sought. In some instances the grain or oil cake is omitted and only the pulp and roughage fed. According to good authority, the daily ration should amount to only about 6 to 10 per cent of the weight of the animal, so that an animal weighing 1,000 pounds would receive from 60 to 100 pounds of pulp, to which should be added roughage to the extent of 10 to 15 per cent of the weight of the pulp and when desired from 2 to 5 pounds of oil cake or grain per 100 pounds of pulp and roughage.

The dried pulp, according to various analyses, consists of from 8 to 12 per cent of water, 4 to 8 per cent of ash, 7 to 8 per cent of raw protein, 18 to 20 per cent of crude fiber, and from 50 to 60 per cent of nitrogen-free extract. In drying the pulp it is first passed through a press which removes from 10 to 15 per cent of the water, and the remaining wet pulp is then transferred to kilns, where the moisture

is reduced to from 8 to 12 per cent, a process which requires from thirty to forty minutes. Other methods may be used in drying the pulp, but whatever the method the purpose is to remove a large part of the water without burning or otherwise changing the composition of the solid matter. In the dried condition the pulp will keep almost indefinitely if stored in a dry place, and it is easily transported. It commands a selling price varying from $12 to $25 per ton, depending upon locality and condition. Good results seem to have been obtained by feeding a mixture of dried pulp (with or without molasses), chopped hay, and oil cake or grain. The total quantity fed must depend, as in the case of the tops, upon the kind of stock and the object sought. While the use of pulp as a stock food has increased rapidly during the last few years, there are still some localities where its value has not yet been recognized.

WASTE MOLASSES.

Waste molasses is the by-product that remains after the crystallizable sugar has been separated from the concentrated beet juice, or molasses. This by-product contains nearly 50 per cent of sugar which can not be separated from the nonsugars by the ordinary methods, owing to the presence of various salts that have been taken up by the beet from the soil in the process of growth. These salts being soluble are extracted from the beet with the sugar and remain in the molasses. In addition to the sugar and salts in the molasses, there are some organic substances which, with the salts, may be classed as nonsugars. As a rule the larger the proportion of nonsugars present the smaller the quantity of sugar that can be separated, a fact which shows the importance of the purity coefficient. The purity coefficient is the number which shows the relation of the sugar in the juice to the total solids in the juice and is determined by dividing the weight of the sugar in a given quantity of juice by the weight of the total solids (combined weight of sugar and nonsugar) in the same quantity of juice.

In addition to the effect of these salts upon the separation of the sugar, they with the organic matter give to the molasses a disagreeable flavor which prevents it from being used for table purposes. The presence of a large proportion of nonsugars, especially of mineral salt, makes the waste molasses a valuable fertilizer, but it could not be used economically for this purpose owing to the great loss of sugar that would result. However, the nonsugars do not prevent the molasses from being used as a stock food provided too large a quantity is not fed at one time or in one day. Feeding molasses to stock has been practiced in Europe for nearly one hundred years, and yet large quantities of so-called refuse molasses have been wasted in this country because stockmen who might have utilized it did not realize

its value. In those sections where it is used as a stock food it is fed to cattle, horses, hogs, sheep, and poultry. It may be dried with beet pulp, alfalfa, or other material for feeding purposes, or it may be used by simply diluting it with about twice its volume of water, in which condition it is fed by itself, or it is sprinkled upon dry hay or other dry fodder. The quantity of molasses used per day depends upon the kind of stock to which it is fed and varies from one-half pound to 6 pounds per thousand weight of the animal. In beginning the use of molasses as a part of the daily ration, it is advisable to start with about one-fourth of the desired quantity and gradually increase the amount from day to day until the full ration is fed. The greatest direct value of the molasses as a stock food is in the sugar, but the nonsugars undoubtedly aid and stimulate digestion and are therefore of great value indirectly if not fed in too large quantities.

Another important use for the waste molasses is in the manufacture of alcohol, including that for denaturing purposes. One gallon of beet molasses, containing about 50 per cent of sugar, weighs approximately 12 pounds and will yield about 3 pints of 95 per cent alcohol; therefore a 50-gallon barrel of waste molasses will produce about 19 gallons of 95 per cent alcohol. Besides alcohol, the distilleries produce as a by-product fusel oil, and the remaining slop or refuse is of great value. Fusel oil finds commercial value in the manufacture of lacquers. Waste molasses is also utilized to some extent in the manufacture of vinegar of a very satisfactory quality. Certain medicinal preparations have been separated from this slop, such as betaine. The slop or refuse of a distillery contains the salts and organic matter that were present in the molasses. From the concentration of this slop, potash salts are obtained and nitrogen compounds are prepared in Germany and other foreign countries that are used as fertilizers. In this country this waste product known as slop is usually dried and ground up with fish scraps or other material and placed on the market as a commercial fertilizer. When these methods of disposing of the waste molasses are practiced, approximately all the material extracted from the beet is utilized.

Formerly waste molasses was used in Europe in the manufacture of soap, three grades of which were produced, namely, hard, medium, and soft. Efforts are being made by the Office of Public Roads to determine the practicability of utilizing waste molasses in combination with other material in constructing blocks for street-paving purposes. Whether or not these blocks will be sufficiently durable for practical purposes can be determined only by a prolonged test, which is now under way.

When the value of denatured alcohol is better understood it will undoubtedly come into more general use, and it is probable that

waste molasses will form an important source of this product. In some countries a portion of the waste molasses is utilized in the manufacture of briquettes by mixing coal dust with molasses, pressing, and drying. It is probable that other uses of a more or less important nature will be found for this by-product from time to time, but even with our present knowledge of the value of this important material not one pound of residuary molasses should be allowed to go to waste.

LIME CAKE.

As already stated, there are certain nonsugars in the beet juice that prevent immediate crystallization of the sugar. In order to remove some of these substances the juice is treated with milk of lime. The amount of lime used in the preparation of the milk of lime is generally about 2 to 6 per cent of the weight of the beets sliced; that is, a factory slicing 500 tons of beets a day will require from 10 to 30 tons of lime daily. The amount needed, therefore, for a 100-day run would average about 2,000 tons, making a total for all the factories in the country of nearly 200,000 tons. After the lime has combined with certain substances in the beet juice, the liquid containing the sugar is pressed through filter cloths and the lime cake remains behind. Comparatively little use has been made of this by-product in this country, while in Europe it is in general use as a fertilizer. So far as we have tested lime cake as a fertilizer it has given satisfactory results in nearly all cases. It is to be especially recommended in the case of acid soils and hard soils that need some material to make them more friable. It is certainly an enormous waste of valuable material to wash the lime cake into the sewers and gullies, as is done in the great majority of American factories at the present time. The difficulty in handling this material and spreading it uniformly over the land is a serious hindrance to its use as a fertilizer. The cost of transportation is also an important consideration in this connection. In a few irrigated sections the lime cake is washed out over the fields with the waste water, under which condition it is spread more or less uniformly and appears to be very beneficial to alfalfa and other field crops. If it could be passed through some process or mixed with some material that would render its handling easier, it would undoubtedly come into more general use as a fertilizer.

Numerous efforts have been made to utilize the lime cake in the manufacture of cement in this country, but, so far as can be ascertained, the tests made have not yet been entirely satisfactory. In Germany this industry has reached commercial importance. That lime cake will eventually be used for some such purpose there can be

no doubt. A small amount of waste lime from beet-sugar factories is now being used in the manufacture of a wall board, the principal ingredients of which are coal tar and waste lime. It has been used in the construction of pavements, roofing, etc., by drying, pulverizing, and mixing with asphaltum.

SEED BEETS.

As the beet-seed industry develops in this country, several additional by-products of the sugar beet will deserve attention, namely, the seed beets after they have gone to seed, seed stalks, and refuse seed. The seed beets increase in size during the second year, often attaining a weight from two to four times as great as the beets had at the end of the first season. The sugar content also deserves considerable attention, often varying from 10 to 14 per cent after the seed has been harvested at the end of the second season. These roots, therefore, represent considerable material per acre, usually from 8 to 10 tons of roots, which, owing to their woody, fibrous nature, are not readily workable in the sugar mill. If passed through a chopper they may be utilized as a stock food, or, considering the large quantity of sugar present, they may be employed in the manufacture of alcohol. At the present time less than 300 acres of beet seed are grown in this country, so that the loss from the nonutilization of these roots is less than in the case of any of the by-products previously mentioned. As the beet-seed industry develops, however, this by-product will become of greater importance. Future possibilities along this line may be realized when we remember that the present needs of this industry call for the total seed production of 5,000 acres and that the industry may be increased fivefold. When this stage of development is reached there will be at least 250,000 tons of seed beets to be utilized in some manner each year.

The seed stalks also represent a large amount of waste material. In Europe efforts have been made to utilize the seed stalks by chopping them up and mixing them with some of the waste molasses for stock food, but owing to their dry, fibrous condition they do not seem to be satisfactory for this purpose. Whether or not any practical use can be found for them remains to be determined.

It sometimes happens that the seed, because of its age or for some other reason, is not satisfactory for planting. It is then best utilized by transforming it into a meal by grinding, when it may be used as a stock food, thereby preventing it from becoming a total loss. Ground beet seed is composed of from 10 to 12 per cent water, 13 to 17 per cent protein, 4 to 8 per cent fat, 32 to 45 per cent nitrogen-free extractive, 13 to 18 per cent crude fiber, and 5 to 13 per cent ash. The ash contains from 20 to 25 per cent potash, 4 to 22 per cent lime, and from 14 to 46 per cent phosphoric acid. It is evident, therefore,

that ground beet seed is valuable for cattle feeding and makes an important addition to the stable manure. In this connection it should be added that under ordinary conditions beet seed will retain its vitality for several years, so that there is little probability under existing circumstances of being obliged to utilize the seed for other purposes than planting.

OTHER WASTE MATERIAL.

In addition to the by-products mentioned, there are several kinds of refuse in sugar factories that should be noted in this connection, namely, waste water, old filter cloth, rubber belting, and gunny sacks.

A 500-ton factory requires about 2½ million gallons of water daily during the time the factory is in operation. This is used in washing the beets, extracting the sugar from the cossettes, in the production of steam, etc. A greater part, however, of the water is used in washing the beets and is allowed to flow off as waste material after it has served its purpose in the factory. In only a few cases is this waste water utilized, but when practicable it has been found very useful for washing alkali out of the soil, for irrigation purposes, or for washing the pulp and lime cake away from the factory.

The old filter cloth is sometimes sold to nurserymen, who use it for wrapping material, or to tomato growers, who use it to protect their plants from late frosts.

Rubber belting when discarded finds ready sale for brake-block lining and for rubber recovery. The large quantities of cloth and belting used in sugar factories make these items of considerable importance as waste material.

A sugar factory utilizing the raw material from 5,000 acres will have not less than a thousand gunny sacks each year that were used in transporting the seed to the factory. If the seed were grown in this country the sacks could be used over and over, but it would not be economy to ship them back to Europe to be refilled. For this reason the factories have large numbers of these sacks on hand, many of which are utilized about the mills in various ways, while others are disposed of to farmers and other buyers at a low price, but amounting to a considerable sum in the aggregate. These sacks are useful in handling potatoes and other vegetables, in covering seed beets and other roots that are to be kept through the winter for seed production, and in many other ways about the farm and garden.

CONCLUSION.

It is apparent from the foregoing statements that several important uses are already known for most of the by-products of the sugar beet. If these by-products should be utilized to the greatest advantage in each of the localities where sugar beets are grown, millions

of dollars would be added directly or indirectly to the annual returns which the farmers and factories now receive from the sugar beet. It is also evident that the greatest money value of a given by-product may be realized when that by-product is utilized in one way in one locality and in an entirely different way in another locality. It is important, therefore, that each by-product be studied in its relation to the conditions and circumstances which exist in the location where the by-products are produced.

THE DEVELOPMENT OF FARM CROPS RESISTANT TO DISEASE.

By W. A. Orton,

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NEED OF IMMUNE VARIETIES.

One of the most effective methods of dealing with plant diseases is to improve our crops so that they will be less subject to injury. When we can introduce into our agriculture varieties possessing a degree of natural immunity and thereby avoid both the loss from disease and the necessity for the more or less expensive treatment by sprays and other means, a double economic gain will be secured.

PLANT DISEASES A HEAVY TAX.

The present losses from plant diseases are a heavy tax upon our farmers. There is little doubt that the average annual loss from oat smut is more than $6,500,000; from loose-smut of wheat, $3,000,000; and from bunt, or stinking smut of wheat, more than $11,000,000. Barley loose-smut annually diminishes the value of barley more than $2,000,000, a careful estimate of the loss in one State last year placing it at 7 per cent of the yield, equivalent to $967,000. The combined effect of the several leaf-blights of the potato is to diminish the yield of this crop over $36,000,000 each year.

The losses from the cereal rusts and from the numerous minor troubles of farm crops, concerning which accurate data are difficult to secure, amount to hundreds of millions of dollars.

Vast as is the direct loss from plant diseases, the indirect losses are also great. The expense of treating plant diseases is very large. Effective preventives have been devised for many troubles, and their application results in the saving of much money, but at the cost of large sums expended for copper sulphate, sulphur, lime, formaldehyde, and other fungicides, and for spraying machinery and the labor of application.

Of still greater consequence is the indirect loss resulting from the limitation of industries. The risk from disease frequently operates to reduce the production of an otherwise profitable crop, and indeed in many cases industries have been abandoned on this account. The history of the grape industry in America affords several illustrations of this.

In the case of diseases like the root-rots and the wilts, which are not readily controlled by sprays or by seed treatment, the development of resistant strains is particularly important.

AN ERA OF PLANT IMPROVEMENT BEGINNING.

There has been of late a marked increase in public appreciation of the importance of improving our crops. New methods have come into use, and valuable results have already been secured.

Much more plant breeding will be done in the future. The productiveness of all our crops must be increased and their quality improved. Yield and quality are naturally the first considerations, but attention may profitably be paid in every case to reducing injury from disease, and in many instances in which a disease is a limiting factor the first aim of the breeder will need to be the securing of resistant strains.

THE IMPORTANCE OF FUNDAMENTAL STUDIES OF DISEASE RESISTANCE.

Too little information is available in the whole field of breeding. Our knowledge of the problems connected with securing disease resistance in plants is particularly limited and the need for investigation is great. The workers in this field must take note not only of problems of heredity but of pathology as well. They must know the nature of the disease, its governing factors, and the type of resistance involved in order to adopt the most promising lines of approach in their breeding.

THE BASIS OF DISEASE RESISTANCE.

ADAPTATION TO ENVIRONMENT.

Leaving out of consideration for the moment those diseases which are due to parasites, it may be pointed out that in order to properly maintain the health and vigor of plants they must be grown in a suitable soil and temperature and supplied with adequate quantities of water and food. Different crops require different conditions, and, within the species, varieties differ in their demands.

We can modify to some extent the environment of a variety for its good, and the success of the farmer depends largely on his ability to do this through knowledge of the needs of his crops and the effect on them of the local soil and climate. Our control over soil and climate is, however, rather limited, and to obtain the best results it becomes necessary to introduce or breed new varieties better adapted to our conditions.

If, before undertaking to secure such new varieties, we inquire why some kinds of plants are suited to moist soils and others to dry

soils, why some require a cool climate and others tropical heat, why some endure acid soils and others thrive only in neutral or alkaline soils, a fact may be learned that will safely guide our future efforts. This fact is that adaptation to a particular set of conditions implies the origination of that variety in the same or a similar environment. During the period of development certain limiting factors operated to preserve adapted variations and to eliminate the unfit until the response of the strain to temperature, light, moisture, etc., came to agree with the average of these factors provided by the local climate.

A large group of plant diseases, including sun-scorch, tipburn, chlorosis, and frost injury, are primarily due to our attempts to grow the affected crops in unsuitable soil or in a climate essentially different from that of their place of origin.

The production of varieties resistant to these physiological diseases will be accomplished mainly by securing better adaptation to soil and climate. Having found, for example, that the potato requires for its best development a cool, moist summer, and that the disease tipburn causes great injury to potatoes on light soils during hot summers, it becomes evident that we should seek to originate varieties of potatoes more resistant to heat. Such a one, for example, is the McCormick, a potato which, in spite of its inferior quality, is largely used in Maryland for summer planting because of its adaptation to warm weather.

Since agricultural conditions vary greatly within short distances, it will in many cases prove desirable to breed locally adapted strains of all the principal crops.

SPECIFIC RESISTANCE TO PARASITES.

Before we can fully understand the nature of disease resistance it will be necessary to study the phenomena of parasitism, a subject which involves some of the most complicated of the many interrelations between organisms which nature has to offer us.

The greater number of plant diseases are due to parasitic plants, usually fungi or bacteria, which live in or on and at the expense of the crop we are attempting to raise. The relation between a parasite and its host is a very close and intimate one. Plant parasites are not freely interchangeable, but as a rule each species of parasite is confined to a single host, like corn smut; to a few closely related ones, as cucumber downy mildew, which also attacks melons and related plants; or to a definite series of hosts, as in the case of apple leaf-rust, which passes from the "cedar apple" on red cedar to the leaves of apples and then back to the cedar. The most highly developed parasites are thus restricted.

In breeding disease-resistant forms we are attempting to still further restrict the parasitic habit. It will therefore profit us to trace the probable evolution of a parasite and the origin of the plant's resistance.

A few algæ and flowering plants belonging to various families have adopted the parasitic habit, but most of the forms causing our common plant diseases are either fungi or bacteria and seem to have been originally saprophytes.

Saprophytic fungi and bacteria live in nature on dead organic matter. This they are able to break down into simpler compounds through the action of enzymes or acids which they excrete. The common molds are familiar examples of such saprophytic fungi. In some cases the enzymes or acids excreted by these molds are poisonous to living plant cells. When such a mold invades living tissue, as, for example, the fruit of an apple, the enzymes go before and kill the cells on which the fungus later subsists. This sort of action takes place in many cases of the so-called "damping off" of seedlings and in the lettuce drop due to sclerotinia. These semi-saprophytes are often very destructive, killing their hosts outright and affording themselves a very limited period for their reproduction and dissemination. They represent the earliest stage of parasitism. Either a wound or a condition of low resistance on the part of the host is required to permit infection to take place. Once a start is acquired toward the parasitic habit, natural selection operates to maintain an equilibrium between parasite and host by restricting the virulence of the former and by building up the resistance of the latter.

To understand how this takes place we must recall that both parasite and host are variable organisms. The fungus produces offspring, some of which possess a higher ability to infect their host, and these through this advantage are preserved. A similar variability exists with respect to the poisonous action of the parasite, and those forms which kill quickly are less able to perpetuate themselves than those which act more slowly and thus secure a longer time for spore formation.

This has been pointed out with reference to diseases of man and animals by Dr. Theobald Smith, who also showed that the natural tendency of the parasite is therefore toward a lessened injury to its host and more perfect adaptation for reproduction and dissemination. Thus it is that we find at the bottom of the scale forms which kill in advance of their growth, and at the top forms, like the rusts and smuts, which grow in the living cells of their host plant without killing them until the parasite's life cycle is about to be closed.

The host species is meanwhile undergoing evolution. It varies, producing some individuals more susceptible and some more resistant

to the parasite, the latter of which are naturally preserved. Thus there is very gradually built up a partial immunity to every fungus which is sufficiently aggressive to be one of the limiting factors in the development of its host. This is the way true disease resistance is developed. We shall therefore find resistance to a particular parasite most developed in varieties of the host that have been for the longest period of time in association with this parasite.

It follows that our search for resistant varieties should begin in the country where the disease has been present longest.

NATURE OF RESISTANCE TO PARASITES.

In modifying plants to lessen the injury done them by parasites the breeder needs to recognize that his object may be secured in several different ways, depending on the nature of the disease. The typical form of disease resistance involves a specific reaction on the part of the host cell against a true parasite, a character developed in nature in the evolution of the species and strengthened in cultivated plants through the work of the breeder. Less important from the breeder's standpoint are plants resistant through (1) structural differences, (2) disease endurance, and (3) disease avoidance.

The first group is the most important, relating as it does to diseases due to the most highly developed parasites, such as the rusts, mildews, and other injurious fungi. We have just seen how the quality of resistance to these fungi may have developed. The evidence indicates that the resistance is due to a specific protective reaction of the host cell against the parasite. In man and the higher animals some forms of immunity have been shown to be due to substances in the blood serum which neutralize the toxin excreted by the invading bacteria and assist in the destruction of the latter. If this is fundamentally a chemical reaction, it is one too complex to have been yet solved by ordinary chemical methods. So in plants the evidence leads us to believe that more is involved than the acidity of the cell sap or the chemotactic effect of sugars or other food substances.

The delicacy of the reaction may be better understood if we recall the fact that it is adjusted to repel specific invaders. A plant resistant to one disease may be quite susceptible to another. General hardiness is also another matter. A plant may be resistant to cold and yet extremely susceptible to the attacks of some parasite.

Structural differences do not seem to play much part in enabling plants to resist the true parasites. Satisfactory demonstrations of cases where resistance to highly adapted parasites is due to thickened epidermis, development of hairs, etc., are lacking. It has on the other hand been shown by Ward and Salmon that germinating spores of fungi often penetrate the epidermis of plants they can not parasitize, and are killed forthwith by the cells they attack. It is hard to under-

stand why a thick cell wall should protect from infection a leaf which has many thousand openings as breathing pores through which a fungus might enter.

Resistance due to structural causes does occur in troubles due to wound parasites, a fruit or a tuber with a thick rind being thereby less liable to bruising; or there may be an indirect connection, a plant of more open habit of growth being thereby less subject to attack by fungi which require moisture for their development.

Disease endurance sometimes results from the ability of the plant to grow in spite of an attack, either through exceptional vigor or through a hardier structure, as in the case of certain melons which better survive the attacks of leaf-blight because the leaves do not dry out as quickly as do those of the ordinary melons. Drought-resistant plants are often disease enduring. Watermelons from semiarid Russia were for this reason the last to succumb to the wilt disease when planted in our Southern States.

Finally, we have disease-escaping varieties. Such, for example, are the extra-early cowpeas which mature before the season for wilt and root-knot to develop. These varieties which escape disease through earliness or lateness are often really very susceptible. The Early Ohio and other early potatoes, which commonly mature before the appearance of the late-blight fungus, are among the first to succumb to this disease if planted so late as to be still immature when the moist weather of the late summer or early fall enables late-blight to spread.

These adaptations may often be utilized by the plant breeder in securing immunity from loss.

THE EFFECT ON CROPS OF CHANGES OF LOCATION.

The development of our agriculture involves endless interchange of crops between localities. The movement of farmers to new, unsettled districts extends the range of our cultivated plants to climates and soils very different from those of their place of origin. Most of these plants have been brought from other countries. Even those whose origin is attributed to America, such as maize, the potato, and tobacco, were not indigenous to our Northern States.

It is highly important that still more introductions of plants from foreign countries be made in the future, so that we may profit from the improved varieties of fine quality and great productiveness that have been developed by the older civilization of other lands. We should begin our attempts to improve our crops by securing as a starting point the best that already exists.

All this should be done in the light of our best knowledge of crop adaptation and the effect of a change of environment upon plants, not overlooking its effect upon their parasites.

A crop grown in one locality for a long period of time gives rise to varieties adapted to that environment. A locality into which a crop is newly introduced is not likely to have perfectly adapted varieties at first. Our best results in each case may be expected of plants from similar climates in the Old World. One of the results of attempting to grow varieties where they are not adapted is the appearance of diseases due to malnutrition, weather injury, etc. Plants native to deep soils dry out quickly in shallow soil and suffer from tipburn, sun-scorch, etc. In our Western States one finds many eastern trees and shrubs with foliage in a yellow or chlorotic condition due to the excess of alkaline salts in the soil, while native plants remain healthy. At some time in the future local strains of these introductions will be originated, which will be able to resist these unfavorable conditions. A splendid example of the possibilities in this direction is afforded in the work done by Mr. T. V. Munson, of Denison, Tex., in hybridizing foreign with American grapes. The new varieties he has originated combine fine quality derived from their foreign parents with the hardiness of the native vine.

Hybridization between introduced and native varieties will be a potent force in improving our crops, but it is not always necessary to resort to crossing to secure adapted or resistant strains, since the desired aim may often be secured through selection. One of the results of changes of location is to promote variability. We find recently introduced farm crops extremely lacking in uniformity, with variants departing in both directions from the normal. Some plants will be superior, and if segregated may form the basis of valuable improved varieties destined to supersede the parent sort.

These exceptional plants are appearing at somewhat rare intervals all about us. The great need is for more farmers who will watch for them and save them. The ultimate result from such work will be varieties much finer than anything we can introduce.

Before passing from the purely physiological disorders we should note that plant introduction bears a still closer relation to diseases caused by parasites. Nearly allied to the examples just cited is the group of diseases due to the action of parasites or semiparasites on plants of lessened vitality. The early-blight or Alternaria leaf-spot of potato is an example. Such diseases occur most abundantly where the soil and climate are not fully suitable for the best development of the crop. We may expect them when we attempt to grow a crop too far out of its natural range, and we can avoid them in many cases by breeding strains better adapted to the local soil and climate.

Such illustrations further emphasize the fact that breeding is a local problem. It must not be expected that varieties which excel in one place will be equally good elsewhere. Each community must originate its own strains.

EFFECT OF CHANGES OF LOCATION ON PARASITES.

We have already noted how natural forces maintain an equilibrium between parasites and their hosts through development of resistance in the host and the restriction of the injury done by the parasite. When man steps in and transfers crops from one country to another, this equilibrium is greatly disturbed.

A parasite which has become so adjusted to its natural host as to cause little injury may be capable of spreading to a related host in another country, and may find that host destitute of natural resistance. In such cases the new disease proves very destructive. The hollyhock rust, for example, when accidentally introduced from Chile, spread rapidly over Europe and America and nearly stopped the culture of this ornamental plant. The downy mildew and the phylloxera of the grape were parasites of the vine in America, where through long-continued association the surviving wild species had developed a high degree of resistance. The European grape, another species, had never been exposed to either downy mildew or phylloxera until they were carried to France in the middle of the nineteenth century. So susceptible to these diseases were the European vines that the great wine industry there was almost ruined before it was discovered that it was possible to effect a remedy for phylloxera by growing the European varieties on the roots of the immune American species and also that hybrids possessing resistance to both pests could be made. The history of this struggle is now about to be repeated with the American gooseberry mildew, a parasite of our native wild species which has already made it impossible to grow the European gooseberries in America. This disease has now appeared abroad and may make it necessary for breeders there to develop new varieties by hybridization with American species.

These examples make it evident that in considering the introduction of a foreign plant subject to a parasite it is not sufficient to know that this parasite does no harm to this crop in its own home. We must also ascertain whether there are any crops in our country related to the proposed introduction to which this parasite is capable of spreading. If there are, it is to be feared that the new parasite will develop hitherto unobserved virulence because of the absence of any resistant qualities in its new hosts.

The converse of this difficulty is also met with in making introductions of foreign crops. They may prove susceptible to attack by a parasite of one of our native plants not hitherto accounted of any importance. Pear-blight is a case in point. This disease is assumed to be endemic on certain wild American pome fruits with which it had reached such a state of equilibrium that little injury resulted. When, however, European pears and apples were introduced by the

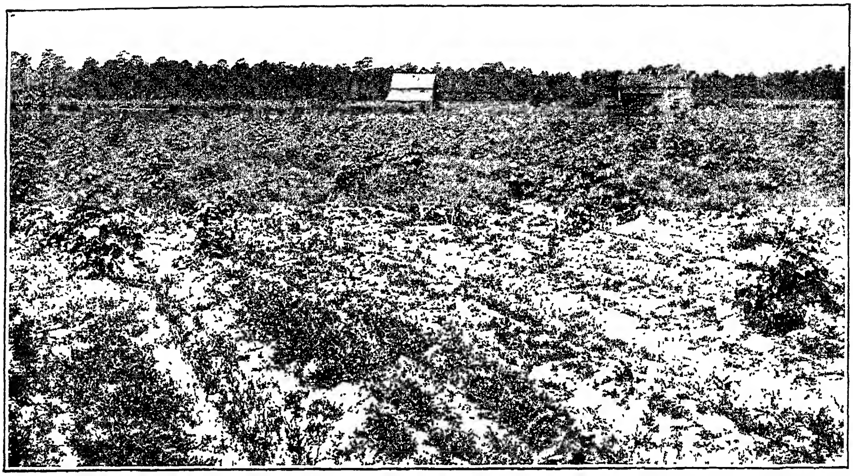

FIG. 1.—A FIELD OF UPLAND COTTON IN SOUTH CAROLINA DESTROYED BY WILT.

[The disease known as wilt remains in the soil many years.]

FIG. 2.—THE FIELD SHOWN IN FIGURE 1 PLANTED WITH THE DILLON VARIETY BRED BY THE DEPARTMENT OF AGRICULTURE TO RESIST THE WILT.

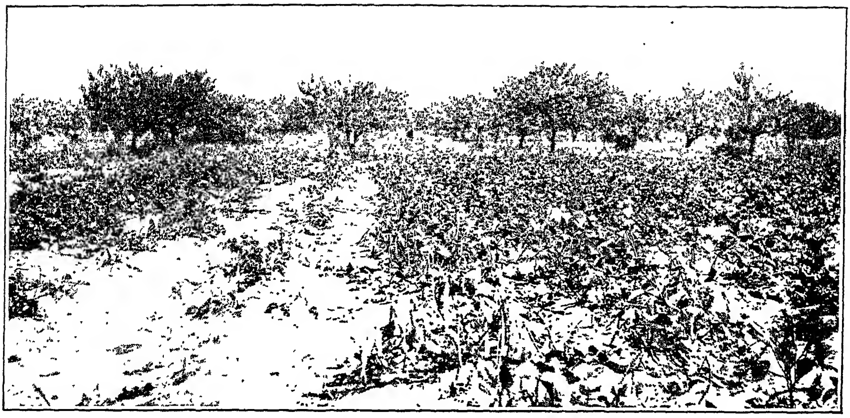

FIG. 1.—FIELD SHOWING COWPEAS RESISTANT TO WILT AND ROOT-KNOT ON THE RIGHT; ORDINARY VARIETIES ON THE LEFT.

[From a photograph showing the breeding plots of the Department of Agriculture in South Carolina.]

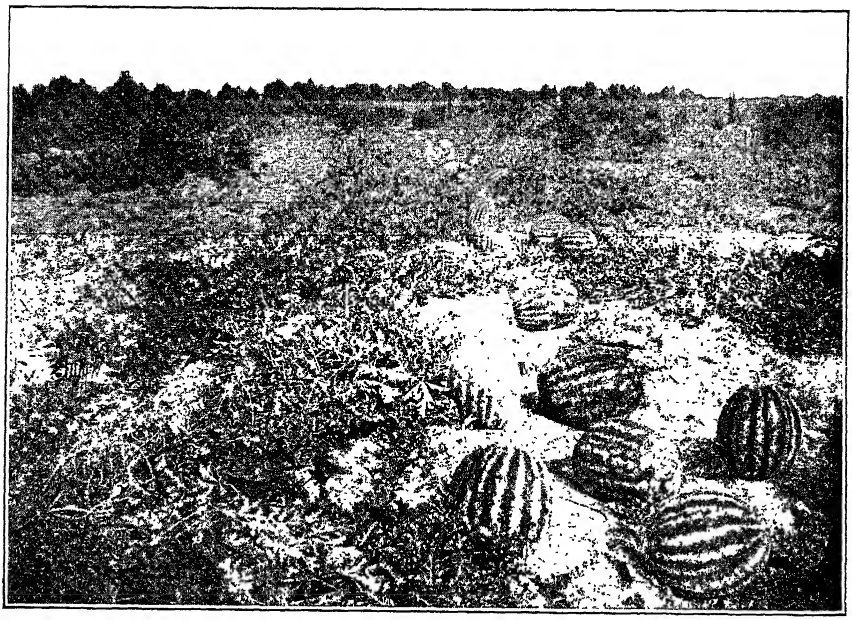

FIG. 2.—FIELD OF WILT-RESISTANT WATERMELONS, GROWING FREE FROM DISEASE ON INFECTED LAND.

[From a photograph showing the breeding plots of the Department of Agriculture in South Carolina.]

early settlers the pear-blight organism found a host with little natural immunity and became at once a highly destructive disease.

A third contingency develops in the case of foreign plants which it is possible to introduce without the parasites which restrict their development at home. There is some doubt as to which alternative we should adopt. If we exclude by a rigid quarantine the natural enemies of an introduced crop, we may assist in widely extending its cultivation. Important industries may be based on it, and new American strains developed possessing little of the natural resistance of the original introduction. Sooner or later the parasite is likely to evade our quarantine and, entering the country, find vast areas of susceptible hosts. The resulting epidemic will cause great loss, as in the case of asparagus rust, which first appeared in the United States in 1896 and in a few years spread from the Atlantic to the Pacific. The alternative would have been to bring over the disease with the crop and allow the industry to develop with this restriction. The result would be, perhaps, a slower economic development of the industry, but if the industry developed at all it would be based on stable grounds and accompanied by the origination of resistant strains.

There are arguments on both sides of this problem. It seems evident that each case should be settled on its own merits and after careful study by pathologists and plant breeders. Regarding our policy with respect to diseases already introduced there can be no doubt. Disease resistance should be bred into our varieties by the most available methods, based on the demonstrated facts of parasitism. Our hope is to find abroad forms naturally resistant to all our introduced parasites. Plant introduction is thus at the same time a great danger and a great hope.

INHERITANCE OF DISEASE RESISTANCE.

The degree to which disease resistance is inherited is naturally a matter of fundamental importance to the plant breeder. The subject has not been sufficiently investigated to warrant wide generalizations, yet so far as we have gone all results indicate that the disease-resistant character is transmitted in the same way as are other characters.

This is to be expected of every case of true disease resistance, for the reason that it is a protective quality developed by the species as a result of the struggle for existence with the parasite. Such physiological characters are transmitted to offspring just as effectively as the form of leaves or fruits.

The chances for success in breeding for disease resistance will therefore be seen to depend on the nature of the parasite, its degree of

adaptation to the host species, the length of time it has been prevalent, and the possibility of crossing the host with related resistant forms.

In dealing with diseases due to wound parasites, weakling parasites, or other semisaprophytic invaders, the likelihood of securing true specific resistance is very small. They are rather to be combated by developing structural protection through thicker epidermis, etc., by securing varieties better adapted to the local soil and climate, or by cultural treatment, the use of fungicides, etc.

In the case of diseases of recent appearance, where the parasite has come over to the crop from native plants, the chances for prompt success are smaller than if the host and parasite had been longer in competition, but careful search may lead to the discovery of exceptional plants possessing some resistance.

Variations in disease resistance ranging in degree from slight to conspicuous ones are to be observed in connection with nearly every epidemic. Selection of the better plants should enable the breeder to raise his strains to higher and higher levels of disease resistance. Not all plants which escape infection transmit this quality to their progeny. The immunity of the parent may have been due to accidental noninfection, or to other causes not inheritable. To distinguish between these and cases of genuine resistance it will be necessary for the breeder to test all his selections in progeny rows.

In some instances, resistant forms arise suddenly instead of through gradual development. For example, in fields of cotton infected by wilt, where most of the plants are killed, there are at rare intervals plants which remain healthy and whose progeny are also nearly immune to the disease. These plants are sufficiently different from the original strain to deserve being called mutations. Such mutations may be expected to occur occasionally, especially in case of disease due to partially adapted parasites, as in the case of the wilt fungus, which is thought to be a parasite of rather recent origin.

FIXED TYPES.

Through rigid selection and especially by breeding from individuals by the progeny-row method a high degree of uniformity may be secured and the offspring come to resemble exactly the parent type. This unusual uniformity can be maintained only by close breeding or by vegetative propagation.

When these restrictions are removed, the fluctuations already described recur. The disease-resistant varieties thus far developed retain this character as well as other highly selected strains would retain their quality or productiveness under like circumstances. Continued selection will always be desirable to maintain the value of these varieties at the highest level.

MENDELISM.

When a disease-resistant variety is crossed with a nonresistant variety, the resulting offspring inherit resistance to a limited and varying extent. In some cases disease resistance behaves as a unit character and is transmitted in Mendelian proportions. Mr. R. H. Biffen, of Cambridge, England, crossed a rustproof wheat with a rust-susceptible variety and obtained in the second generation approximately one-fourth of the offspring resistant and three-fourths susceptible, indicating that in this case resistance was a recessive Mendelian character. This is an important and suggestive experiment which Mendelian enthusiasts have assumed to prove that wherever there is found a resistant form to cross with, this character can be bred into any variety, and that a strain combining all the desired qualities will come pure in the third generation.

The experience of this Department in making such crosses encourages the hope that the disease-resistant character can be transferred in this way from one variety to another, but indicates that in order to combine with it the necessary commercial characters of flavor, productiveness, uniformity in appearance, etc., several years of selection are required.

EXAMPLES OF DISEASE RESISTANCE.

Reference has already been made to the development of wilt-resistant varieties of cotton, cowpeas, etc. A brief summary of the progress to date along this line may be in place here.

(1) Wilt-resistant Sea Island cotton.—To combat a wilt disease due to the attack of a soil fungus, it was necessary to breed for resistance. Several strains have been secured by the planters and this Department, of which the "Rivers" is the most noteworthy. Others are "Centerville" and "Sensation," all of which are resistant enough to grow on the worst infected land. They originated from rare mutations and have been improved by selection.

(2) Wilt-resistant Upland cotton.—Since the ordinary Upland cotton belongs to a different species from Sea Island cotton and is even more susceptible to wilt, a separate breeding campaign had to be undertaken. This has yielded two varieties, Dillon and Dixie, very resistant to wilt and of excellent productiveness. These also have been perfected by selection from resistant parents. (See Pl. XXXIX, figs. 1 and 2.)

(3) Wilt-resistant cowpeas.—One variety of cowpea, the Iron, apparently of chance origin, was found resistant to both wilt and root-knot. Hybrids between this and other varieties have given rise to disease-resistant strains. (See Pl. XL, fig. 1.)

(4) Wilt-resistant watermelon.—The watermelon wilt, due to a soil fungus allied to that causing cotton wilt, is a disease attacking all kinds of watermelons with great virulence, but not occurring on the stock melon, or citron. A hybrid between the latter and a watermelon, recrossed with the melon, seems to combine wilt resistance with the characters of a good melon. (See Pl. XL, fig. 2.)

(5) Disease resistance in potatoes.—Prof. L. R. Jones and Prof. William Stuart have shown that there are varieties of the potato partially resistant to late-blight and probably also to scab; that these features have received considerable attention abroad, but very little in this country, though there are undoubtedly great possibilities ahead of our breeders.

(6) Anthracnose-resistant clover.—Bain and Essary, at the Tennessee Agricultural Experiment Station, have made marked progress in developing strains of clover resistant to anthracnose, a fungous disease attacking stems and leaves. Their results were obtained primarily by selecting chance resistant individuals.

(7) Leaf-blight-resistant cantaloupe.—P. K. Blinn, of the Colorado Agricultural Experiment Station, has been propagating a resistant strain of cantaloupe called the Pollock, from the grower who discovered it. This melon is partly resistant to leaf-blight and also endures infection better on account of its firmer leaf.

(8) Rust-resistant wheat.—The most notable case of disease resistance in wheats is the resistance of the durum group to rust, as demonstrated by Carleton. They greatly excel other groups in this regard, and thereby fill a great need in the agriculture of the Great Plains region.

(9) Wilt-resistant flax.—A disease widely prevalent in flax-growing regions, due to a fungus related to that causing cowpea wilt, has been successfully combated by Prof. H. L. Bolley, of the North Dakota Agricultural Experiment Station, who has developed strains so highly resistant that they grow well on badly infected land.

SOIL MULCHES FOR CHECKING EVAPORATION.

By Samuel Fortier,
Chief of Irrigation Investigations, Office of Experiment Stations.

VALUE OF WATER FOR IRRIGATION.

The value of water for irrigation purposes is steadily increasing throughout the arid region. In some of the well-watered States bordering on the continental divide, canal water rights some fifteen years ago were considered high at $10 an acre. The same rights now sell readily for double and treble that amount. The estimated cost of water rights under the Government irrigation projects has been increased from time to time and now averages nearly $40 an acre. In localities possessing a climate adapted to high-priced products, like that of southern California, the value of water is much higher. The last water rights sold under the Gage Canal of Riverside, Cal., cost the purchasers $250 an acre.

By reason of the scanty rainfall a western farmer must not only secure a water right for all the arable portions of his farm, but he must likewise contribute an annual water rental ranging from 50 cents to $5 an acre to defray the expenses of operating and maintaining a canal system. These charges when added to the cost of preparing his fields for irrigation and of applying the requisite amount of water make the total average cost per annum about $10 an acre.

WASTE OF IRRIGATION WATER.

The results of investigations by the Office of Experiment Stations on the use of water in the West during the past decade point to the conclusion that by far the greater part of the water diverted from natural sources of supply for irrigation purposes is wasted. This line of investigation in the warmer, fruit-producing localities of the West, where water is scarce and valuable, led to a consideration of how much water passes into the air in the form of vapor from newly irrigated orchards and fields. This work was begun at Riverside, Cal., several years ago and the results are summarized in Bulletin No. 177 of the Office of Experiment Stations. These results showed the great influence which dry, granular, soil mulches exerted in checking evaporation from the damp soil beneath. So large a percentage of irrigation water was conserved by this means that it was decided

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to broaden the field of operations and determine what effect such mulches would exert in other localities of the West. Accordingly experiments were established in the spring of 1908 at Davis, Cal., Wenatchee, Wash., Reno, Nev., Mesilla Park, N. Mex., and Bozeman, Mont., the experiments being carried on in cooperation with the State experiment stations.

EQUIPMENT USED IN EXPERIMENTS FOR DETERMINING THE INFLUENCE OF SOIL MULCHES.

The equipment consists of eight or more water-jacketed tanks, the outer vessel being 27 inches in diameter and 43 inches deep and the inner 23 inches in diameter and 46 inches deep. The inner vessel has

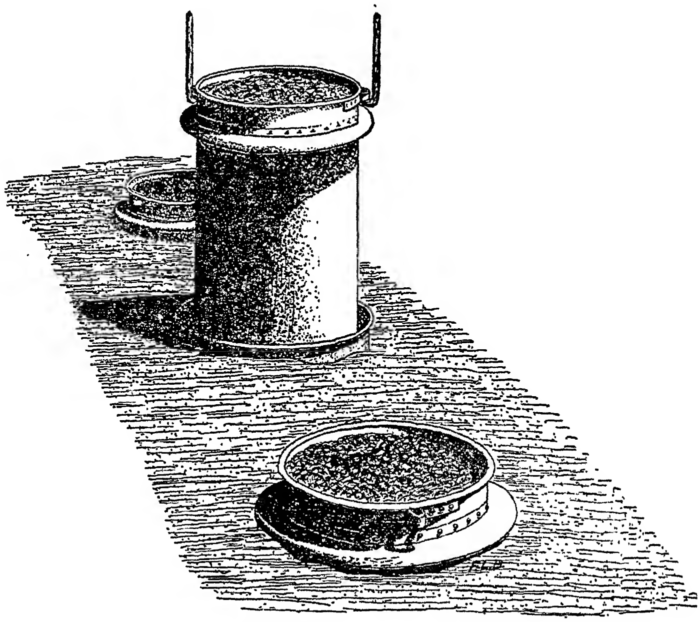


FIG. 22.—Water-jacketed tanks used in evaporation experiments.

sufficient capacity to hold nearly three-quarters of a ton of soil, and when placed inside the larger vessel the 2-inch space between the two was filled with water so as to maintain an even temperature approximately equal to that of the adjacent soil. Figure 22 shows the tanks and their position relative to the ground surface. After being installed the outer tank was not disturbed, but the inner tank, containing the soil, moisture, and mulch, was hoisted and weighed at frequent intervals. In filling the inner tank with soil an effort was made to secure conditions similar to those in the natural soil. Each foot in depth of soil as it was excavated was kept separate, was placed in the tanks in 2-inch layers, and slightly compacted by tamping.

The soil used was carefully examined and the amount of moisture it contained determined. The temperature of the air was likewise observed and recorded, as well as that of the water and soil surfaces, during the time of each test. The results are briefly summarized by means of the following diagrams and tables.

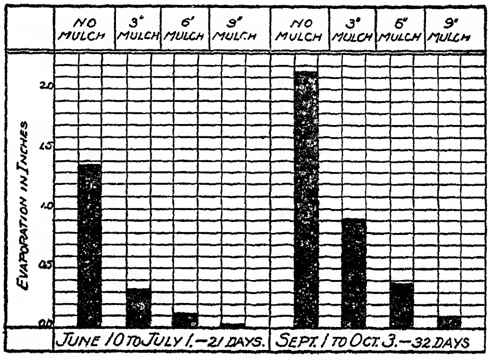


FIG. 23.—Evaporation at Davis, Cal., 1908.

RESULTS OBTAINED AT DAVIS, CAL.

The site selected for the experiments was part of an open field on the university farm, bordering on the town of Davis, located in the Sacramento Valley, 76 miles north of San Francisco and 13 miles west of Sacramento. The soil is a rich brown loam to a depth of 2½ to 3 feet, and gradually merges into a light sandy subsoil.

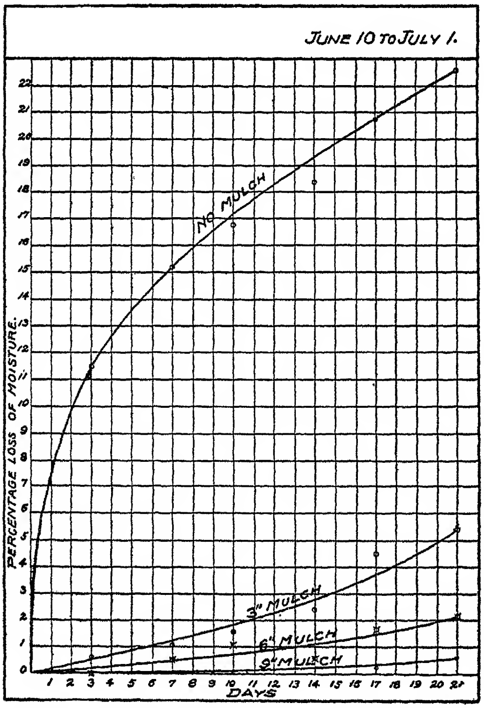


FIG. 24.—Curves showing daily rate of evaporation, Davis, Cal.

From June 10 to July 1, a period of twenty-one days, the length of the first test, the daily maximum temperature of the air in the shade averaged 87.4° F. and the minimum temperature 49.3° F. During the day the temperature of water in an open tank varied from 60° to 88° F. and averaged 76°, while the average temperature of the soil taken 6 inches below the surface was several degrees higher than that of the water.

In filling the tanks with soil it was arranged that Nos. 1 and 2 should have no mulch, 3 and 4 a 3-inch mulch, 5 and 6 a 6-inch mulch, and 7 and 8 a 9-inch mulch. Before beginning the test

each tank received a medium irrigation of 6 inches in depth, equivalent to 94 pounds. The tanks were weighed on Wednesday and Saturday of each week. The evaporation losses occurring between these dates are shown in the following table and graphically in figure 23.

The daily rate of evaporation computed on the basis of percentages of the total amount of water applied in one irrigation is shown in figure 24. By this it will be seen that the tanks having no mulch lost on an average 11 per cent in three days after the water was applied to the surface, while the loss at the end of twenty-one days was 21.92 per cent. The loss in the tanks protected by dry-soil mulches was as shown.

Evaporation from soils protected by different depths of soil mulch at Davis, Cal., June 10 to July 1, 1908.

	No mulch, tanks 1 and 2.		3-inch mulch, tanks 3 and 4.		6-inch mulch, tanks 5 and 6.		9-inch mulch, tanks 7 and 8.	
Average weight of tanks June 10 (pounds)..	1,206.0		1,189.7		1,118.7		1,091.5	
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Average loss 3 days, June 10 to 13	10.75	11.45	0.5	0.53	0.0	0.0	0.0	0.0
Average loss 4 days, June 13 to 17	3.5	3.73	.5	.53	.5	.53	0.0	0.0
Average loss 3 days, June 17 to 20	1.5	1.6	.5	.53	.5	.53	0.0	0.0
Average loss 4 days, June 20 to 24	1.5	1.6	.75	.80	−0.5	−0.53	0.0	0.0
Average loss 3 days, June 24 to 27	2.25	2.39	2.0	2.13	1.0	1.07	.25	.27
Average loss 4 days, June 27 to July 1......	1.75	1.82	.75	.80	.5	.53	.25	.27
Total loss, 21 days, June 10 to July 1..	21.25	22.59	5.0	5.32	2.0	2.13	0.5	0.54

A second trial was made at the same place in the same manner and with the same equipment between September 1 and October 3, 1908, a period of thirty-two days. The weather conditions as recorded did not differ materially from those of June, when the first trial was made. The results of the various weighings are shown in the following table and also graphically in figure 25.

The daily rate of evaporation (fig. 25), as in the June test, shows an excessive evaporation from the unmulched soil during the first few days after water was applied. This loss in three days amounts to more than 17 per cent of the water used, and in thirty-two days to nearly 35 per cent. The loss in the tanks having a 3-inch mulch was 14.71 per cent, in those having a 6-inch mulch 5.94 per cent, and in those having a 9-inch mulch only 0.78 per cent.

Evaporation from soils protected by different depths of soil mulch at Davis, Cal., September 1 to October 3, 1908.

	No mulch, tanks 1 and 2.		3-inch mulch, tanks 3 and 4.		6-inch mulch, tanks 5 and 6.		9-inch mulch, tanks 7 and 8.	
Average weight of tanks, Sept. 1...pounds..	1,104.7		1,090.0		1,082.0		1,085.2	
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Average loss, 3 days, Sept. 1 to 4............	16.75	17.83	1.75	1.86	0.0	0.0	0.0	0.0
Average loss, 4 days, Sept. 4 to 8............	4.5	4.79	.75	.80	.25	.27	−0.5	−0.53
Average loss, 3 days, Sept. 8 to 11...........	3.0	3.19	2.25	2.4	.75	.80	−0.25	−0.27
Average loss, 4 days, Sept. 11 to 15..........	1.5	1.60	2.5	2.66	....	....	....	....
Average loss, 18 days, Sept. 15 to Oct. 3......	8.0	8.52	7.0	7.45	4.75	5.05	2.25	2.4
Total loss, 32 days, Sept. 1 to Oct. 3...	33.25	35.93	14.25	15.17	5.75	6.12	.75	.80

RESULTS OBTAINED AT WENATCHEE, WASH.

The experiments in the State of Washington were made on an orchard in the fruit district of Chelan County, near the town of Wenatchee. The altitude of this locality is about 850 feet, and in both climatic and soil conditions it resembles much of the orchard lands of the north-central portion of the State. The soil is a sandy loam several feet in depth, and contains more or less grit. The annual precipitation is about 15 inches.

The equipment and the manner of conducting the experiments were similar to those previously described. The first trial extended from June 2 to 24, 1908, and during this period of twenty-one days temperatures of the air in the shade, taken at noon of each day, averaged 79.7° F.

The graphic illustration given in figure 26 shows the great difference in the amount of water evaporated from freshly irrigated soils without mulch and those which contain an equal amount of moisture protected by dry-soil mulches of varying depths. Thus the average percentage of moisture lost by evaporation in the tanks having no mulch was $14\frac{1}{3}$, while the loss from the tanks which were protected by 3-inch, 6-inch, and 9-inch mulches were 3.98, 2.10, and 1.06 per cent, respectively.

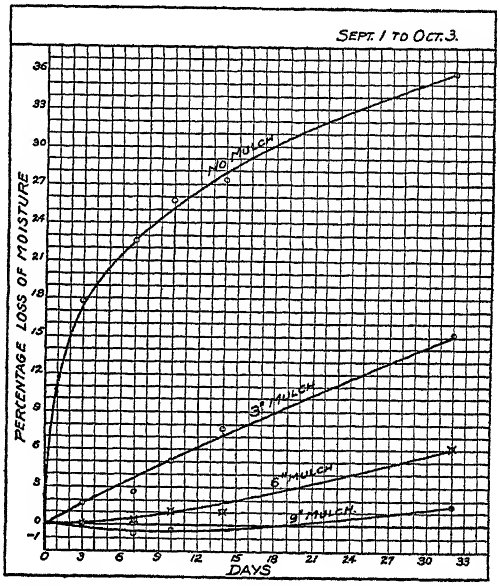


FIG. 25.—Curves showing daily rate of evaporation, Davis, Cal.

RESULTS OBTAINED AT RENO, NEV.

The experiments were conducted on a plat of ground in a corner of the agricultural experiment station farm near Reno. Other than a light woven-wire fence, there were no obstructions to wind, sunshine, and rain. The soil used was a sandy loam containing small fragments of rock, and in drying after being irrigated the surface crusted over more or less.

On the morning of June 9, 1908, the tanks were filled with soil containing on an average 11 per cent of free moisture. On June 12 sufficient water was applied to equal a 6-inch irrigation, and after

it had been absorbed the mulches were added and the weight of each tank recorded. Thereafter the entire set of tanks was weighed regularly twice a week for three weeks, and from the losses indicated by these weighings the diagram shown in figure 27 has been prepared. Here as elsewhere the amount of evaporation decreases with the increase in the depth of soil mulch.

The average percentage of moisture evaporation in the tanks having a 9-inch mulch was 1.96, that in the tank having a 6-inch mulch 4.74, and that in the tanks having a 3-inch mulch 8.26, while the tanks without any mulch lost on an average 20.39 per cent.

A slight amount of rain fell during the test, but it was allowed for in the determinations. The average temperature of the air in the shade, taken at 8 a. m. and 5 p. m. on each day, was 70.9° F.

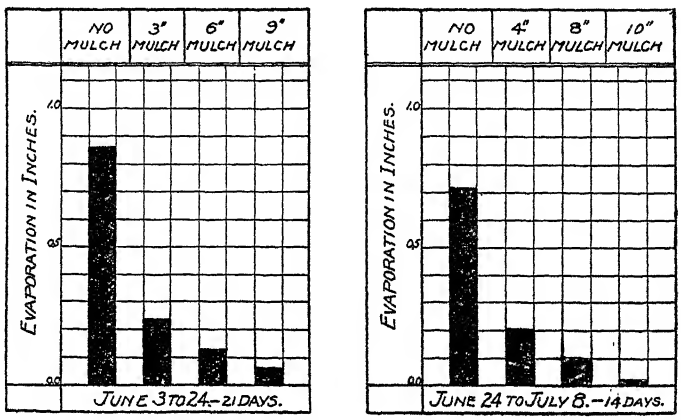


FIG 26.—Evaporation at Wenatchee, Wash., 1908 (on the left), and at Riverside, Cal., (on the right).

RESULTS OBTAINED AT BOZEMAN, MONT.

The site selected was on a part of the State agricultural experiment station near Bozeman, in the Gallatin Valley. The soil is a silt loam on the surface, underlaid with a heavy clay loam. The altitude of the station farm is 4,750 feet. As one would naturally expect, the winters are usually dry and cold, the springs cool and rainy, and the summer days hot, with comparatively cool nights.

The mean monthly temperature for September for eight years has been 52.8° F., and the average precipitation for the same period 1.23 inches. The experiment was carried on with the usual form of apparatus, the tanks being filled September 1, and the experiment begun on September 2. The average of the temperatures at 9 a. m. and 4.30 p. m. during the experiment was 65° F.

The influence exerted by a layer of dry-soil mulch is again shown in figure 28. It will be observed that the amount of water evaporated is

much greater in this experiment than it is in others where the weather was warmer and where one would expect a greater loss from this cause. This is readily accounted for by the excessive amount of moisture in the soil when the tanks were filled, the percentages ranging from 21 to 26 per cent of the dry weight of the soil.

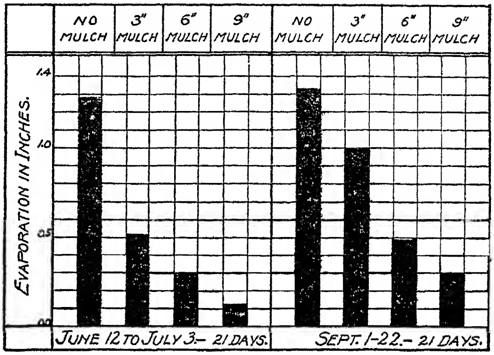


FIG. 27.—Evaporation at Reno, Nev., 1908.

CONCLUSIONS.

The results of experiments herein briefly summarized are fairly uniform in character. This is a little surprising when one considers that the experiments were carried on in widely separated localities of the arid region by different agents and under different climatic and soil conditions. These facts seem to warrant the presentation of the following conclusions:

It seems to be clearly demonstrated that a large part of the water which is spread over the surface of soils in summer irrigation passes from the soil into the atmosphere without serving any useful purpose. In the tests recorded the time varied from fourteen to thirty-two days and averaged over twenty-two days, while the average percentage of irrigation water which was lost by evaporation from surface-irrigated soil was 27 per cent of the amount applied.

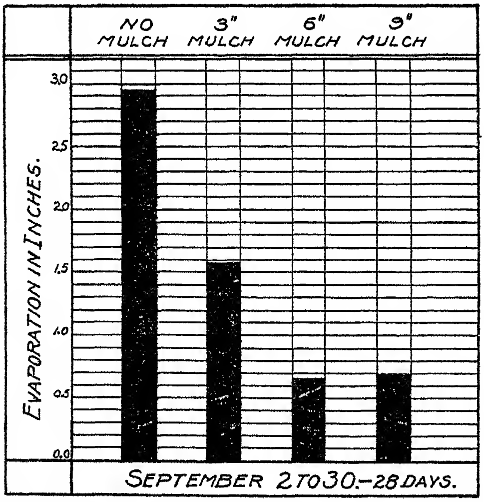


FIG. 28.—Evaporation at Bozeman, Mont., 1908.

Figures 24 and 25 likewise show that in the case of surface irrigation and no mulch the greater part of the total loss from this cause occurs during the first few days after the water is applied. It is well known that the more water a surface soil contains the greater is the evaporation. On completely saturated soil at Riverside, Cal., the evaporation was found to be over 4 inches a week in midsummer.[a]

[a] Evaporation Losses in Irrigation. Eng. News, vol. 58, No. 12, pp. 304–306, Sept. 19, 1907.

In devising ways and means of checking the excessive evaporation losses from irrigated orchards and fields, it has been found that the deep furrows and the dry, granular soil mulch are the cheapest and best preventives. The influence of the latter is clearly shown in the tables and diagrams of this article. Judging from these the deeper the mulch the less the evaporation, but there are practical considerations which limit the depth of soil mulches. A depth of less than 9 inches and more than 3 inches would meet the requirements of the arid region in general.

PROMISING NEW FRUITS.

By William A. Taylor,
Pomologist in Charge of Field Investigations, Bureau of Plant Industry.

DEVELOPMENT OF FRUIT DISTRICTS.

The rapidity with which the production, testing, and commercial dissemination of new varieties of fruits is proceeding in a region may fairly be taken as an index to the condition of fruit growing therein. During the pioneer period the fruits planted are usually those brought by the settlers from their former homes or obtained from older settled regions of climatic conditions similar to those existing in the new region in so far as they are understood. Later there follows a period of great activity in seedling production, during which large numbers of varieties of local reputation are enthusiastically disseminated before undergoing a test sufficiently extended and varied to render possible even an approximate estimate of their relative values for given conditions or particular uses.

Gradually the strong and weak points of such varieties are ascertained, and the lists for planting in particular regions and localities, especially in commercial orchards and vineyards, are narrowed down to comparatively few sorts. In America, during the past three or four decades, the general tendency has been to reduce the number of sorts planted to even a much smaller number than in corresponding portions of the European continent. This has been largely due to the influence of the commercial demand for solid carloads or even trainloads of fruit of single varieties at one time to meet a market demand in a more or less remote section of the country or even across the sea.

There is evidence of a reawakening of interest, however, in the growing of a wider range of varieties of some of our more important fruits, such as the apple, for purely commercial ends. There is also indication of a growing discrimination in many markets between general-purpose varieties of ordinary or indifferent quality and some of the choice sorts which are particularly adapted to special uses and therefore worthy of higher prices.

New climatic districts are still being developed through the extension of suitable transportation facilities, as well as by the development of water for the irrigation of soils rich in fertility but hitherto lacking in moisture. The mastery of previously destructive insects

and fungi, through the methods of control that have gradually been developed by entomologists and pathologists, now renders possible the growing of some choice sorts in districts where they formerly could not be depended upon to succeed.

It is the purpose of this article, in continuation of those on the same subject in the Yearbook since 1901, to suggest to fruit growers in various sections of the country certain little known or recently introduced fruits that are worthy of their attention either for the home fruit garden or the commercial plantation.

PATTEN APPLE.

SYNONYMS: *Duchess No. 3; Patten's Duchess No. 3; Patten's Greening.*

[PLATE XLI.]

The early settlers of the fertile regions of the upper Mississippi Valley took with them trees of many of the standard varieties of fruits of the longer settled country farther east, but soon found that they would not endure the fluctuating and severe winter weather in combination with the hotter and drier summers of the region. Encouraged by the relative hardiness and productiveness of the Oldenburg, Alexander, Tetofski, and Red Astrachan apples, which, though of Russian origin, had been introduced from England by the Massachusetts Horticultural Society about 1835,[a] efforts were put forth to secure hardier varieties from the colder regions of Europe, particularly from Russia, a work in which the late A. G. Tuttle, of Baraboo, Wis., the United States Department of Agriculture, the Iowa Agricultural College, and a number of nurserymen and fruit growers in various States and the Dominion of Canada participated, from 1866 to a comparatively recent date.

Of the hundreds of varieties thus introduced and tested, most have proved of little value under the new conditions, lacking either in flavor, keeping quality, or other important characteristics of fruit, or in blight resistance on the part of the tree. A few valuable sorts have been thus obtained, however, which are doubtless proving a sufficient recompense for the expenditure of labor, time, and money occasioned by this introduction work.

Meanwhile, from these and the earlier introductions, there have been appearing in recent years a considerable number of American seedlings, from which will doubtless eventually come the varieties adapted to the peculiar conditions of the region. Some of these are distinct improvements on the parent varieties in vigor of growth, time of ripening, resistance to blight, and other important characteristics, and while none of those of proved "ironclad" hardiness yet

[a] John Craig, in Cyclopedia of American Horticulture, p. 1404.

developed has revealed high dessert quality, some of them show distinct improvement in this particular.

Among the most promising hardy sorts thus developed is the Patten, which was grown from seed of Oldenburg planted by Mr. C. G. Patten, at Charles City, Iowa, in 1869. Mr. Patten named the variety Patten's Greening, and introduced it in 1885, since which time it has been widely disseminated through the States of the upper Mississippi Valley and throughout the adjacent portions of the Dominion of Canada. Its vigorous and sturdy tree, coupled with regular and sufficient productiveness in climates too severe for most varieties, and its longer keeping quality than most of the hardy sorts, render it increasingly popular in those regions.

DESCRIPTION.

Form roundish oblate, slightly ribbed; size large; cavity regular, of medium size and depth, with gradual slope, russeted; stem of medium length, stout, downy; basin regular, of medium size and depth and gradual slope, sometimes slightly russeted and leather cracked; calyx segments rather broad, converging; eye large, closed; surface smooth; color greenish yellow, with a dull bronze blush on the sunny side, occasional high-colored specimens attaining a brilliant crimson blush; dots scattered, russet or gray, with subcutaneous green bases; bloom whitish; skin rather thick, tenacious; core roundish oval, of medium size, nearly closed, clasping; seeds plump, medium in size, brown, few; flesh yellowish, moderately fine grained, breaking, juicy; flavor subacid to rather acid; quality good, especially for culinary use. Season October to January in the upper Mississippi Valley. The variety is recommended for that region and for those portions of the Rocky Mountain States which experience winter temperatures too low for the standard varieties.

The specimens illustrated on Plate XLI were grown at the Central Experimental Farm at Ottawa, Canada, and were furnished through the courtesy of Prof. W. T. Macoun, horticulturist.

BENNETT APPLE.

SYNONYM: *Bennett Seedling.*

[PLATE XLII.]

This promising new member of the well-known Winesap group of apples originated as a seedling in an old fence row on the premises of Mr. S. L. Bennett, Medford, Oreg., about 1883. Mr. Bennett cut scions from the seedling about 1893, which he top-grafted into bearing trees on his place. Fruit of it was exhibited at the Charleston Exposition in 1902, where it was awarded a gold medal, and at the St. Louis Exposition in 1904, where it received a silver medal award.

It was first commercially propagated about 1903 by J. S. Barnett, Central Point, Oreg., and was commercially introduced by him. It has been considerably planted in the Rogue River Valley of Oregon during the past five years, but so far as known has not yet been fruited outside of that section.

DESCRIPTION.

Form roundish conical, often unequal; size large to very large; cavity regular, large, deep, russeted; stem short to medium; basin regular, of medium size, furrowed and downy; calyx segments long, narrow, converging, slightly reflexed at tips; eye medium, closed; surface smooth, gently undulating; color deep yellow, washed with mixed red and brokenly striped with crimson; dots small, yellow, many indented; skin medium thick, tenacious; core of medium size, broad, conical, clasping, closed; seeds small, plump, brown, numerous; flesh yellow, moderately fine grained, breaking, juicy; flavor rich subacid; quality good to very good. Season November to June in Grant County, Oreg.

The tree is described as similar to Winesap in color and appearance of wood and foliage, except that the leaves are larger. It is reported to be an early and heavy bearer.

The variety is suggested for testing in sections where the Winesap succeeds, especially along the northern boundary of the Winesap belt.

The specimens illustrated on Plate XLII were grown by the originator, Mr. S. L. Bennett, at Medford, Grant County, Oreg.

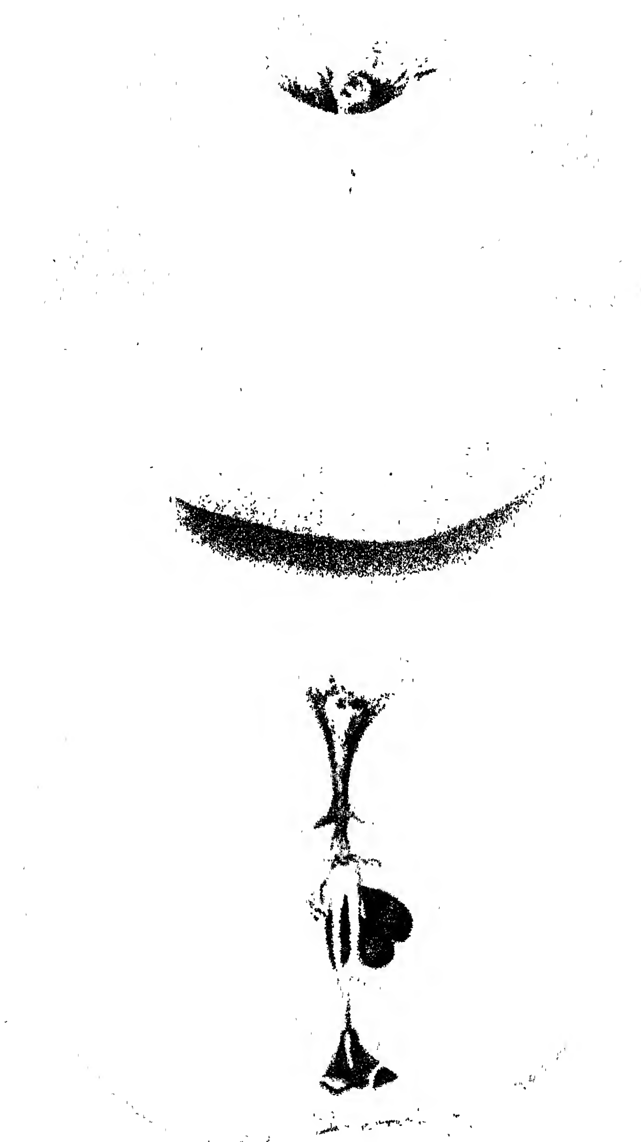
WILLIAMS APPLE.

SYNONYMS: *Early Williams, Ladies, Queen, Williams Early, Williams Early Red, Williams Favorite, Williams Favorite Red.*

[PLATE XLIII.]

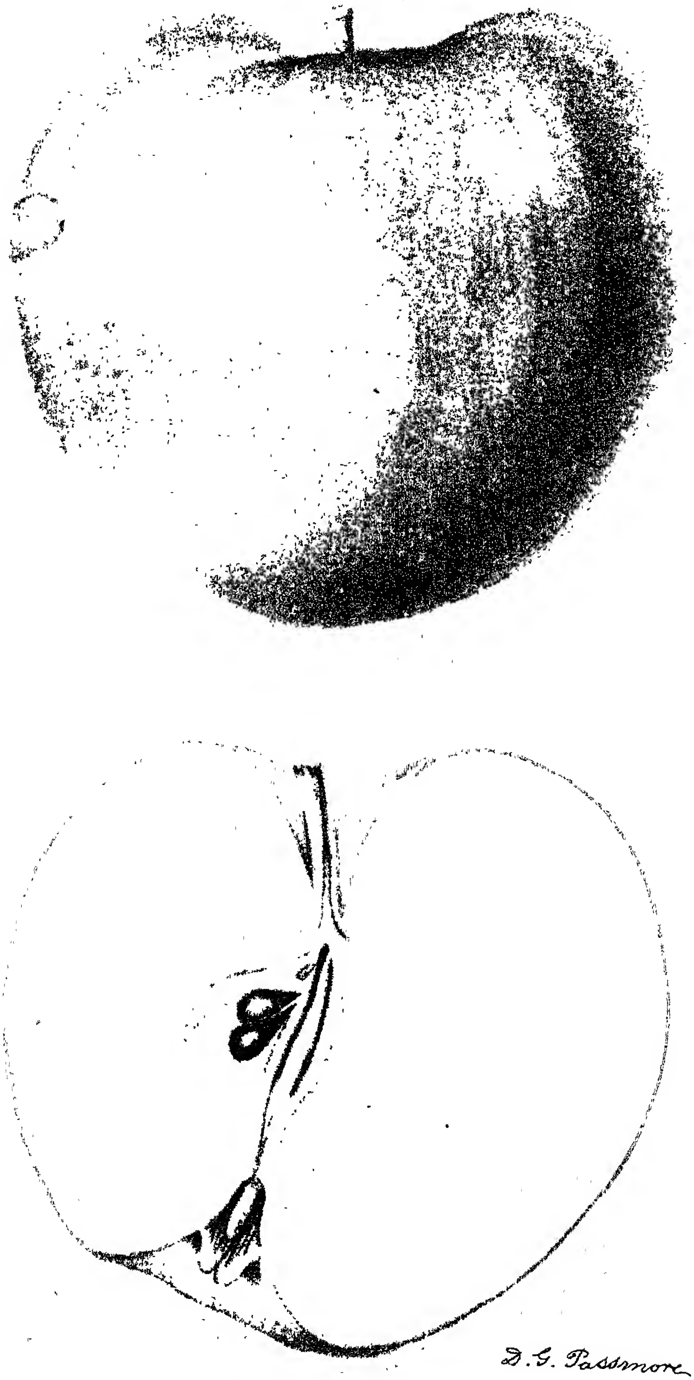
Though discovered as a "wilding" on the farm of Capt. Benjamin Williams, "in that part of Roxbury formerly called Canterbury,"[a] more than a century and a half ago, the full merit of this choice summer apple does not appear to have been recognized until recently. The exact time of its discovery does not appear to have been recorded, but by 1830 it was reported by Samuel Downer to have been "well known in the [Boston] market for some years past, under the name Queen, Ladies, etc." The original tree had been blown down some years previous to that time. Fruit of the variety was exhibited by Mr. Downer before the Massachusetts Horticultural Society on July 24, 1830, with the result that the committee which passed upon it recommended that it be called the "Williams" apple, under which name it was published in the New England Farmer on the following

[a] C. M. Hovey, Mag. of Hort., 1848, p. 118.

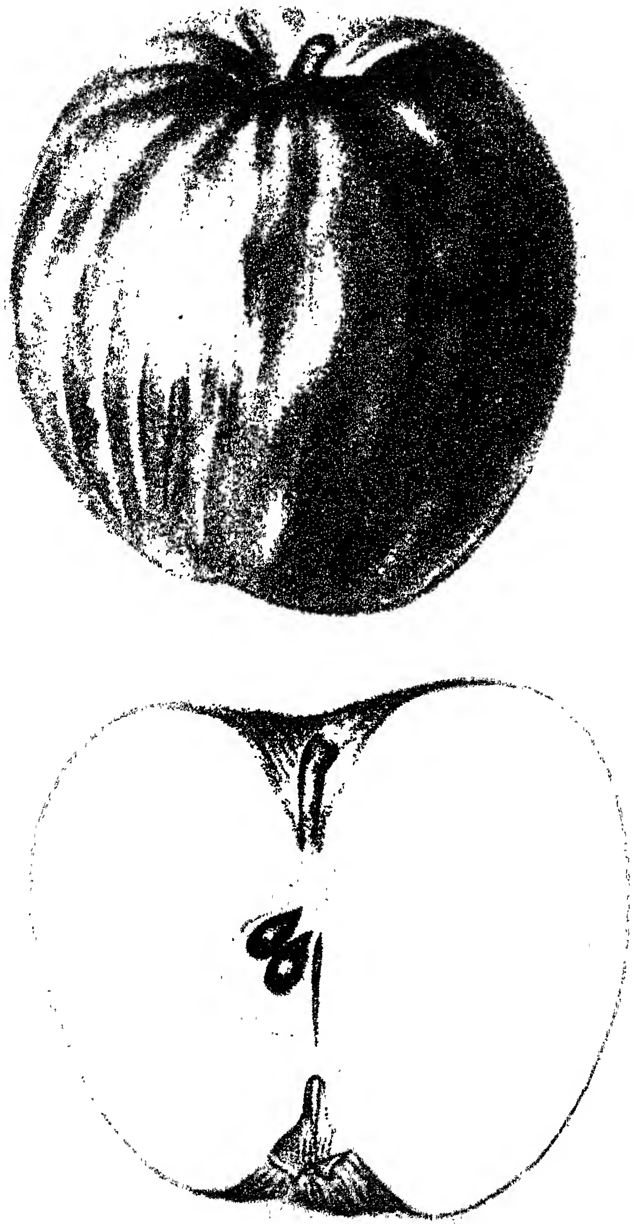


D. G. Passmore

PATTEN APPLE.



BENNETT APPLE.



D. G. Passmore

WILLIAMS APPLE.

Saturday.[a] It subsequently acquired numerous synonyms, but has been more widely grown as *Williams Favorite* and *Williams Early Red* than under the original and preferred name, which we follow.

As a commercial sort its planting has chiefly been restricted to the vicinity of Boston and New York until within the past few years, when it has gradually worked its way southward through New Jersey and Delaware, and still more recently has disclosed its special merit as a summer apple for both home use and market in portions of North Carolina and South Carolina, where few northern varieties succeed.

Its firm flesh and relatively tough skin render it one of the best early varieties for long carriage, and such tests of transatlantic shipment as have been made indicate that high prices can be had for it in July and August in the markets of the United Kingdom.

One reason for including the variety in this series is the fact that some other very much inferior varieties (notably Sops of Wine) have recently been mistakenly disseminated for it and that the frequency of its submittal to the Department for identification from the Middle and South Atlantic States indicates that it is not well known there.

DESCRIPTION.

Form oblong oval to oblong, sometimes rather angular; size medium to large; cavity small, shallow, often heavily lipped; stem medium to long, often thick and knobbed and usually inserted at an angle; basin small, usually shallow, slightly furrowed; calyx segments broad, converging; eye small, tightly closed; surface smooth, sometimes marked with russet knobs; color whitish yellow, heavily washed and striped with two shades of red; dots numerous, russet, partly indented, some aureole; flesh yellowish white, deeply stained with red at core line; breaking, tender, moderately juicy; core oval, of medium size, slightly open; seeds long, dark brown, numerous; flavor mild subacid; quality good, sometimes very good. Season late July and early August in Delaware.

The tree is a rather slow grower and does better if top-worked on a vigorous stock. Some of the finest specimens of this variety seen in recent years have been grown in Delaware, Virginia, North Carolina, and South Carolina, and its planting in an experimental way in those States is suggested.

The specimens illustrated on Plate XLIII were grown by A. N. Brown, Wyoming, Kent County, Del.

AUGBERT PEACH.

[PLATE XLIV.]

The Augbert peach is stated by the originator, Mr. Joel Boon, of Lindale, Smith County, Tex., to have been grown about 1897 from

[a] New England Farmer, Saturday, July 30, 1830, p. 14.

seed of Elberta. The mother tree stood near a tree of Salway, which variety is supposed to have been the other parent. The original tree, which is still living, began bearing at the age of 3 years and has produced seven successive crops, yielding 20 crates of peaches in 1904. Its relatively late season of ripening, coupled with the productiveness of the tree and the beauty and fine quality of the fruit, soon led to its propagation for planting in orchards, and in 1905 to its extensive propagation for commercial dissemination and introduction by C. W. Wood, Swan, Tex., and John F. Sneed, Tyler, Tex. The arbitrary word "Augbert" was registered as a trade-mark for it in the United States Patent Office, June 26, 1906, by Milton E. Fowler, of Lindale, Tex., and its formal introduction appears to date from that year.

DESCRIPTION.

Form oblong oval; size large; cavity regular, large, deep, abrupt, marked with red; stem stout; suture deep, extending beyond apex; apex conspicuous, protruding one-fourth to three-eighths inch above the general outline; surface smooth; color yellow, blushed, mottled and striped with crimson; dots minute; down short, loose, velvety; skin moderately thick, tenacious; stone long, ovate, pointed, medium to large, red, free; flesh thick, yellow, stained with deep red at the stone, tender, melting, juicy; flavor subacid, vinous; good to very good; tree vigorous, productive; leaves lanceolate, of medium size, with short petioles; glands reniform; flowers small. Season August 1 to 20 in Smith County, Tex., two to four weeks after Elberta.

The Augbert, combining, as it apparently does, the productiveness, beauty, and carrying quality of the Elberta with the later ripening season and better dessert quality of Salway, is considered especially promising for Texas and other southern peach districts where a good commercial peach ripening later than Elberta is desired.

The specimens illustrated on Plate XLIV were grown by Milton E. Fowler, Lindale, Smith County, Tex.

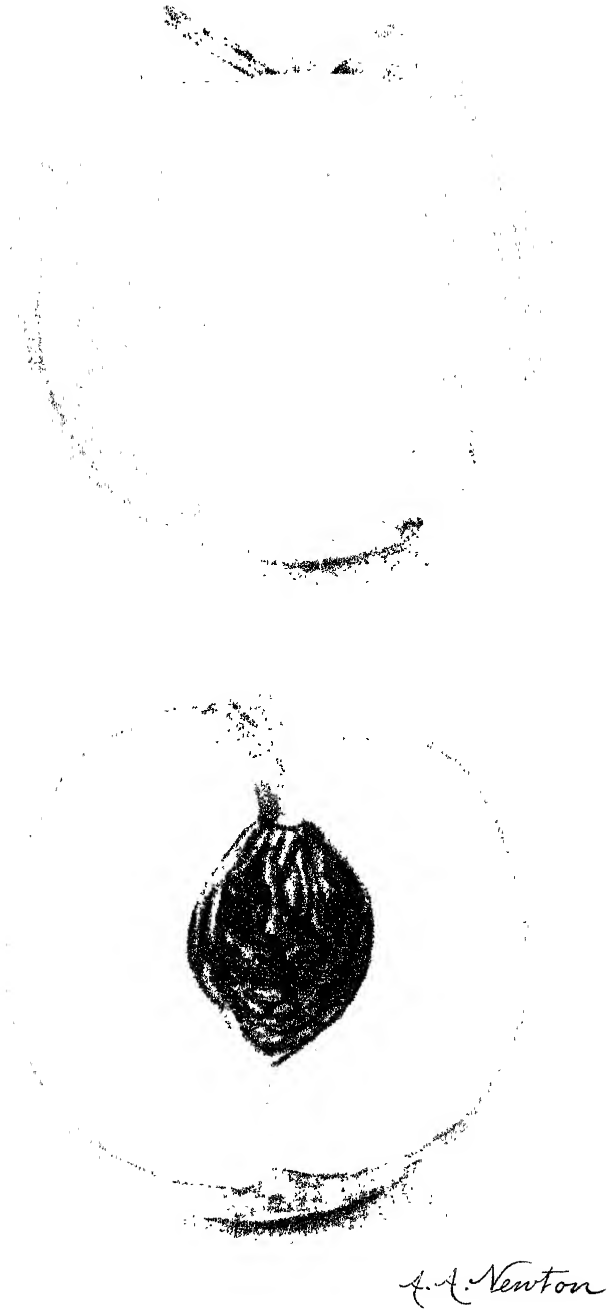
CHAMPION PEACH.

[PLATE XLV.]

Among the hardy peaches introduced during the past twenty years, perhaps none has more steadily advanced in the estimation of growers in the peach districts of the Middle Western States than the Champion. This variety was originated from seed of Oldmixon Free (supposedly crossed with Early York) by Mr. I. G. Hubbard, Nokomis, Ill., now of San Marcos, Tex., in 1880.[a] It was first bud-

[a] Letters of I. G. Hubbard, August 18, 1890, March 20, 1909.

AUGBERT PEACH.



CHAMPION PEACH.

ded for his own planting about 1882, and was introduced by him and the Dayton Star Nurseries in 1890. An illustration and description of it were published in the Horticultural Art Journal in December, 1889.[a] While rather subject to fungous injury of the fruit in wet seasons, its blossom buds under ordinary conditions endure such low temperatures without injury that it has become recognized as possessing special merit for portions of Illinois, Indiana, Kansas, Nebraska, Iowa, Missouri, and other sections, where somewhat similar winter conditions prevail. On the grounds of the originator in Illinois it has borne a fair crop of fruit after experiencing a winter temperature of 18° F. below zero.

In the early years of its dissemination it was somewhat confused with an early, semicling, serrate-glanded variety originated by Eugene Gibson, of New Richmond, Mich., which was locally introduced by him in western Michigan and northern Ohio under the name "Champion," about 1887 or 1888. That variety was subject to mildew of the foliage and its fruit was of little value, but, having been rather largely propagated and disseminated (though without publication), it caused much disappointment among growers who fruited it, thus operating to the disadvantage of the Illinois variety when it was introduced.

DESCRIPTION.

Form round to roundish oblong; size medium to large; cavity large, deep, flaring; stem short; suture distinct from base to apex; apex small but rather prominent, extending beyond the outline of the fruit; surface smooth; color creamy white, washed and striped with red where exposed to the sun, and dulled by abundant, short, persistent down; skin thick; stone short, broad, oval, pale, of medium size, very free; flesh white, slightly stained with pink at the stone, thick, firm, melting, juicy, vinous; quality good to very good when well grown and thoroughly tree-ripened. Season medium, second half of August, in Montgomery County, Ill.

Tree vigorous, with rather light-colored bark; leaves of medium size, with serrulate margins and petioles of medium length, bearing small, reniform glands; blossoms small.

The specimens illustrated in Plate XLV were grown by Mr. John Dice, Cedar Rapids, Iowa.

EATON RASPBERRY.

[PLATE XLVI.]

The original bush of this very promising new raspberry appears to have been found by Mr. Ulysses Eaton at Cambridge City, Ind., as a chance seedling in his berry field in 1885. He propagated this

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[a] Horticultural Art Journal, December, 1889, p. 92.

and planted it for his local market. In 1898 accounts of the large size and fine quality of its fruit reached Mr. Amos Garretson, who visited the discoverer and, being impressed with the value of the variety, secured some plants of it from Mr. Eaton for testing at his home at Pendleton, Ind. These succeeded so well that in 1900 he purchased from Mr. Eaton the right to introduce the variety. Not being a nurseryman, he later arranged with Flansburgh & Pierson (later Flansburgh & Potter), of Leslie, Mich., to commercially introduce it, which they did in 1902.[a]

Fruit of it was exhibited by Mr. Garretson at the Pan-American Exposition at Buffalo in 1901, where it was awarded a bronze medal, and at the Louisiana Purchase Exposition at St. Louis, Mo., in 1904, where Mr. Garretson made six successive shipments a week apart, two in June and four in July, to demonstrate its long ripening season. He states that he has had ripe berries of it as early as June 20 and fruit from the same hills August 10, indicating a length of season very desirable in a variety for home use and for some markets.

DESCRIPTION.

Roundish to roundish conical; large to very large, with a rather irregular undulating surface; drupelets broadly grooved and glossy; color clear, bright, durable crimson; pedicel slender, studded with prickles, receptacle of medium size, rather smooth, releasing the berry easily; calyx of medium size, pale; flesh red, translucent, tender, moderately solid, quite firm, but juicy; seeds relatively small; flavor mild subacid, with an agreeable aroma; quality good to very good for both dessert and culinary use. Season July 1 to August 10, in Madison County, Ind., lasting for several weeks.

The bush is described as of moderate vigor, with a distinct tendency to branch, but making fewer suckers than most other red varieties.

The hardiness and other desirable characteristics of this variety, as proved in Indiana and Michigan, render it promising for other northern districts.

The specimens illustrated on Plate XLVI were grown by Flansburgh & Potter, Leslie, Mich.

PETERS MANGO.

SYNONYM: *Peters No. 1.*

[PLATE XLVII.]

In addition to Mulgoba[b] and Sandersha[c] mangos previously described in this series, another East Indian variety, the Peters, has

[a] Letter of Amos Garretson, January 18, 1909.

[b] For description and illustration of Mulgoba see Yearbook 1901, p. 389, Plate LI.

[c] For Sandersha see Yearbook 1907, p. 314, Plate XXXV.

EATON RASPBERRY.

PETERS MANGO.

shown sufficient merit during the past two years to warrant a more general testing.

This variety was obtained in 1899 by Messrs. Lathrop and Fairchild, at the Botanic Garden of Trinidad, British West Indies, in the form of five potted plants. These plants were distributed in 1900, under Seed and Plant Introduction No. 3706, with the following note:[a]

> Five potted plants of the Peters No. 1 mango, reputed by Mr. J. H. Hart to be the finest flavored of all the mangoes; green skinned, rosy purple blush, and mottled with small yellow dots. Skin thick, flesh pulpy, juicy, high-flavored. Ripens best in dry climate of Jamaica; good and regular cropper; tree medium size, healthy grower; weight of fruit, 12 to 16 ounces; size, 3½ by 3½ inches.

Mr. J. H. Hart, late superintendent of the botanical department of Trinidad, who has had the variety under observation in the West Indies for thirty-three years, states[b] that it was introduced to both Jamaica and Trinidad about 1868 or 1869. Upon his arrival in Jamaica in 1875 he found it growing under the name "Bombay," but on arriving in Trinidad in 1887 he found trees of it growing there under the name "Peters."[c] Trees standing side by side with the "Peters" bore the names "Peach" and "Malda," respectively, and closely resembled it in character of fruit, the "Peach" being distinguished from the others by being more highly colored on the sunny side. He considers the three sorts closely related, possibly seedlings from a common parent. From 1865 to 1887 these trees were propagated from by the dozens, but the demand is now so large that they are being grafted by thousands, both by the Government establishment and by private growers.

Mr. Hart states that, like other mangos, the Peters does well in the dry districts in the West Indies, but in damp, tropical locations the fruit is often subject to an unidentified disease which causes a darkening and souring of the flesh next to the seed just previous to ripening.

DESCRIPTION.

Form roundish oblong, heavily shouldered at base and plump at apex; size medium; stem rather stout, inserted in a small, shallow cavity; apex swollen, with a broad, strong beak an inch or more from the extremity of the fruit; surface moderately smooth, color greenish yellow, blushed, striped, and splashed with light and dark red; dots numerous, yellow; bloom bluish white; skin moderately thick, tenacious; seed small, oblong, thin, adhering tenaciously; flesh

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[a] Section of Seed and Plant Introduction Inventory No. 8, Jan. 1, 1901, p. 35.

[b] Letters of January 23 and April 5, 1909.

[c] Though suspiciously similar in name this is apparently not the "Peter" of the Calcutta Botanic Garden as described by Firminger in Manual of Gardening for Bengal and Upper India, London, 1864, p. 198.

thick, yellow, meaty, tender, and juicy, with but little fiber; flavor sweet, aromatic, rich; quality good to very good. Season July 15 to August 1 in Manatee County, Fla.

The tree is described as of broad, spreading habit.

While the variety has not yet been tested in Florida for a sufficient time to determine its relative adaptability to the mango-growing localities in that State, it is considered worthy of testing both for home use and market where other sorts or seedlings succeed.

The specimen illustrated on Plate XLVII was grown by Mr. J. T. Pettigrew, Manatee, Fla.

KAWAKAMI PERSIMMON.

[PLATE XLVIII.]

The larger size and brighter color of the Japanese persimmons have to some extent attracted the attention of southern fruit growers away from the hardier though less conspicuous native species. In recent years, however, a number of promising varieties of the more widely distributed of our native species, *Diospyros virginiana*, have been named and introduced. There has at the same time been a general recognition of the desirability of growing hybrids of these species in the hope of securing varieties hardier than the Japanese and yielding larger and possibly less astringent fruits than the native parent. One such appears to have resulted from an accidental cross of the Yemon (synonym *Among*) on Josephine, on the grounds of Prof. T. V. Munson, of Denison, Tex., about 1893.[a] Professor Munson grew a large number of seedlings of Josephine from seeds of a tree of that variety near which stood several trees of Yemon. From among these he selected a number that showed thicker and more pubescent twigs and larger leaves than their seed parent, resembling in these respects the Japanese species. Some of these showed much more strongly marked Japanese characteristics in tree and fruit than does this one, which he named Kawakami in 1902, but he preferred it to them because of its superior hardiness and vigor of growth as well as its marked retention of the distinctive flavor of the Josephine, which is considered superior to that of most of the Japanese varieties known in this country.

Professor Munson propagated the variety for dissemination about 1903, 1904. Its behavior thus far warrants the belief that it is considerably hardier than any of the Japanese varieties yet tested in this country and likely to succeed through a wide geographic range.

DESCRIPTION.

Form roundish oblate, sometimes quadrangular; size medium to large; cavity regular, of medium size and depth, with gradual slope,

[a] Letters of T. V. Munson, October 12, 1908, and April 2, 1909.

covered with bloom; calyx small, segments reflexed; stem short, stout; apical point, short, stout; surface moderately smooth; color brownish yellow, covered with a bluish white bloom; skin thin, tender; seeds plump, broad, of medium size and number; flesh yellowish, translucent, with yellow veins, crisp, meaty, tender, moderately juicy; flavor sweet and rich, with but slight astringency; quality good to very good. Season medium to late, September 15 to November 1, in northern Texas. Tree more spreading and stocky than Josephine but less productive. It has thus far endured the winters as far north as Farmingdale, Ill., and is considered worthy of testing throughout the native persimmon belt.

The specimen illustrated on Plate XLVIII was grown by T. V. Munson & Son, Denison, Tex.

LONESTAR PERSIMMON.

[PLATE XLVIII.]

The Japanese persimmon (*Diospyros kaki*), which was recorded in America by Prince[a] as early as 1828, though reintroduced by the Department of Agriculture in 1863, apparently did not attain a permanent foothold in the United States until about 1875, when it was introduced in the form of grafted trees both by the Department and by private parties. Numerous plantings have been made from time to time by growers in California and the Gulf States, with varying success both as to endurance and productiveness of trees and desirability and marketability of fruit. The early vernation and blossoming habit of this species, which starts into growth under the influence of short periods of warmth in winter and early spring, render it much more susceptible to injury by late spring frosts in the South than the widely distributed native persimmon (*Diospyros virginiana*). This sensitiveness to warmth in winter apparently constitutes the most important limiting factor of its cultural range.

Several of the well-known imported varieties are abundantly productive and yield fruit of such conspicuous size and brilliant color as to render them very attractive in the market. Most of these, however, retain their characteristic astringent flavor until the fruit is fully ripe, and, in fact, so soft as to be incapable of transportation or handling in commerce. This makes necessary the harvesting and shipment of the fruit while still hard, so that it reaches the market in an inedible condition, though attractive and tempting in appearance. The result is that notwithstanding the warnings to the purchaser against eating the fruit before it is soft, which are given by the growers and dealers, and which in some cases have even been

[a]A Short Treatise on Horticulture, by William Prince, New York, 1828, p. 37.

printed upon the paper used in wrapping the fruits for shipment, a considerable proportion of consumers have been so disappointed in the quality of the fruit that they have tasted prematurely that the demand for Japanese persimmons in our markets has increased but slowly in recent years.

The Japanese appear to have overcome the difficulty to a large extent by subjecting the fruits to the fumes of saki in closed vessels for a time after they are picked. This has the effect of removing the astringence in advance of the softening of the fruit, and under the climatic and economic conditions prevailing in that country appears to afford a fairly satisfactory solution of the difficulty. Tests of this method now being made by the Bureaus of Chemistry and Plant Industry may eventually lead to its adoption in this country on a commercial scale.

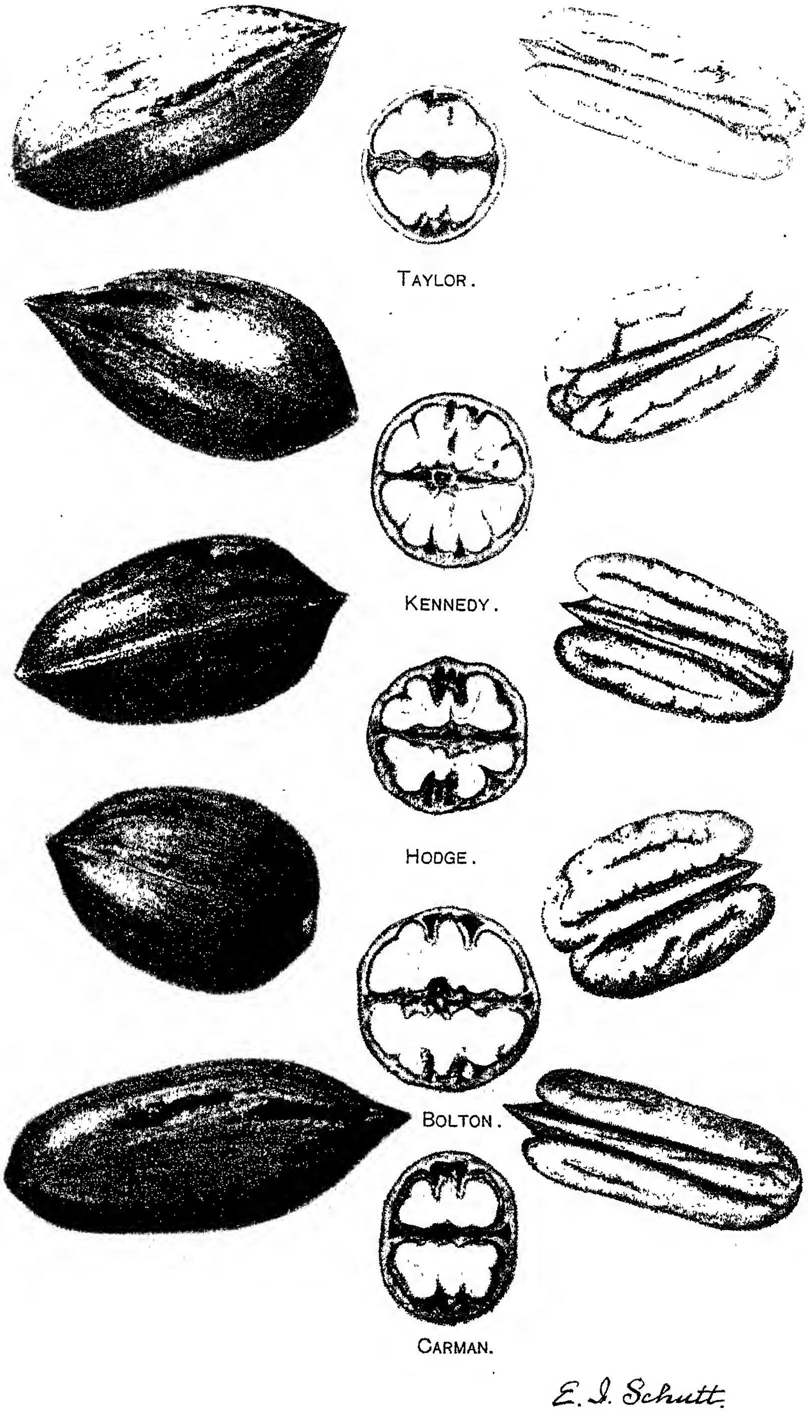
Meanwhile there has come to light an interesting and promising variety of the Japanese persimmon, which ripens late, keeps long, and loses its astringence considerably in advance of the softening of the fruit. The variety was found by the late Mr. C. Falkner in his collection at Waco, Tex., several years ago. The tree found was of unknown history, and the exact source from which it was derived is unknown. Mr. Falkner was of the opinion, however, that it reached him among other Japanese fruit trees from Tyler, Tex., which had been forwarded from Japan by the late ex-Governor R. B. Hubbard, while United States minister to Japan [1885–1889].

As the varieties of the Japanese type previously known to Mr. Falkner were inedible until soft and the fruit of this tree remained hard and apparently unripe after the others had ripened, Mr. Falkner considered it of little value until he observed that birds were eating the fruit while it was still hard. On testing it he was surprised to find it palatable and free from astringence. Having confirmed the observation during several seasons, during which he endeavored to ascertain the identity and Japanese name of the variety, he propagated it in considerable numbers for a commercial orchard and introduced it under the name "Lonestar" in 1908, shortly before his death. It bears some resemblance to the Japanese illustration and description of "Shimo-Maru," published more than twenty years ago, but lacks certain of the most striking characteristics ascribed to that variety.

DESCRIPTION.

Form roundish to roundish oblong; size medium; cavity regular, rather large, flaring, furrowed, and somewhat leather cracked; calyx medium, four parted, adherent; stem moderately stout, curved; apex four grooved, with a small tip protruding slightly beyond the outline of the fruit; surface rather dull, undulating, and sparingly

PERSIMMONS.



PECANS.

pitted; color dark orange-red, covered with bluish white bloom which persists in the pits; skin moderately thick and tenacious; seeds few, of medium size, plump, brown; flesh orange-red, abundantly flecked with purple, giving it a brownish effect in many specimens; texture crisp and meaty; flavor sweet, rich, entirely without astringence after the skin reddens; quality very good. Season August to October in McLennan County, Tex.

The specimens illustrated on Plate XLVIII were grown by the late Mr. C. Falkner, at Waco, Tex.

The relative hardiness of the variety yet remains to be determined, as it has not been fruited elsewhere than at Waco. It is considered worthy of trial throughout the territory where other varieties of the Japanese species succeed.

PECANS.

[PLATE XLIX.]

The planting of extensive commercial orchards of this valuable nut in the Southern States continues, and interest in the species as a roadside and dooryard tree through a much wider geographical range has become active. While the importance of securing varieties adapted to local conditions is much less in such cases than where a commercial investment depends upon it, planters of even a few trees should endeavor to secure varieties that are known to have succeeded under conditions similar to those under which they are to be planted. This is especially important where the planting is made in a different climatic region from that in which the varieties originated.

The earlier plantings of budded and grafted trees of ten or twelve of the leading varieties are now gradually coming into bearing in widely separated localities throughout the South, so that a fairly definite appraisal of the value of these sorts for many sections should soon be possible. Meanwhile the behavior and characteristics of the thousands of seedlings of these choice varieties that are annually coming into bearing should be closely observed, with a view to locating still more promising varieties that may reasonably be expected to appear among them.

TAYLOR PECAN.

The original tree of this variety is supposed to have been grown from a nut planted by the brother of the present owner, Miss Lulu Taylor, of Handsboro, Miss., about 1885. The exact source from which the seed came is not known, but it is supposed to have been from some tree in that neighborhood. The tree began bearing when 12 years old and has borne regularly since that time, the crop for several years past having averaged about 125 pounds. The variety was first propagated by W. F. Heikes, of Huntsville, Ala., at his Biloxi,

Miss., nursery, about 1901, and, having been named in honor of its owner, was introduced by him in 1902. Nuts of it were examined and passed upon by the committee of nomenclature and standards of the National Nut Growers' Association at Scranton, Miss., in November, 1906, at which time it received a grade of 86.06 out of a possible 100.

The original tree of the Taylor is now about 60 feet tall,[a] with a spread of 45 to 50 feet, and a trunk diameter of about 18 inches. The bark of the trunk and larger branches is scaly, loosening in long strips. The tree is pyramidal in form, with slender wood of rather light color, with slender buds, and long, narrow dots. The leaves are long, with 11 to 13 thin and tapering leaflets. The fruit spurs are quite evenly distributed throughout the tree, and bear from 3 to 5 nuts each.

DESCRIPTION.

Form long, rather slender, constricted near middle, slightly curved, with pointed base and long, sharp apex; color bright yellowish brown, with few and narrow black markings irregularly placed; size rather large, 60 to 65 per pound; shell thin, with thin and soft partitions, cracking very easily; kernel long, slender, rather deeply grooved, but plump, smooth, and releasing the shell easily; color bright yellowish; texture very fine grained and crisp; flavor sweet, nutty, free from astringence; quality very good.

Though not yet fruited, so far as known, outside of the locality of its origin in southern Mississippi, its numerous desirable qualities indicate that it is worthy of testing where other Gulf coast varieties succeed.

The specimens illustrated on Plate XLIX were grown on the original tree at Handsboro, Miss.

KENNEDY PECAN.

The Kennedy pecan originated as a seedling grown by Dr. J. B. Curtis, Orange Heights, Fla., in 1886, from nuts of Turkey Egg obtained by him from the late Arthur Brown, of Bagdad, Fla. It was one of the same lot of seedlings as the Curtis,[b] and has had much the same history as that variety. It began bearing about 1893, and was first propagated by Doctor Curtis, who top-grafted 6 trees with it about 1898 or 1899, which averaged 50 pounds of nuts per tree in 1908. Doctor Curtis named it Kennedy, in 1900, under which name it was described by Hume in that year.[c]

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[a] Tree description furnished by Mr. C. A. Reed, special agent.

[b] For history, description, and illustration of Curtis, see Yearbook, 1906, p. 368, Plate XXXII.

[c] Florida Agricultural Experiment Station Bulletin 54, August, 1900.

DESCRIPTION.

Form long, ovate conical, with a bluntly pointed base and sharp, prominent apex, sometimes sharply curved; size medium, 60 to 65 nuts per pound; surface smooth; color bright golden brown, with a few irregular purplish stripes toward apex; shell medium in thickness, rather hard, but with thin and brittle partitions; cracking quality good; kernel very plump, thick, with rather narrow but shallow grooves; texture moderately fine and solid; flavor sweet; quality good.

The tree is rather round topped, low headed, symmetrical, and spreading. The young wood is of medium caliber, dull gray, with short, acute buds, and numerous long, narrow, light gray dots. Like the Curtis it is leafy, with the fruit spurs well distributed through the tree. The nuts are borne in clusters of two to four each, and ripen in Alachua County, Fla., October 15 to 20. The variety is recommended for middle and northern Florida, and it is worthy of testing wherever the Curtis succeeds.

The specimens illustrated on Plate XLIX were grown by Dr. J. B. Curtis, Orange Heights, Fla.

HODGE PECAN.

While the northern limit of natural distribution of the pecan is in the vicinity of Davenport, Iowa, in the Valley of the Mississippi River, and of Terre Haute, Ind., in the Wabash Valley, very few of the wild pecan trees now surviving north of the Ohio River yield nuts of sufficiently large size, thin shell, and plump kernel to justify their perpetuation by budding or grafting. The inability of most, if not all, of the far southern varieties to endure the low winter temperatures that occasionally occur in the northern portions of the pecan region renders them of little prospective value to northern growers. There is much interest, therefore, in the search for desirable varieties likely to prove hardy in the Middle Western and Middle Atlantic States.

One of the most promising sorts of this character thus far brought to notice is the Hodge, the original tree of which is owned by Mr. H. G. Hodge, of York, Clark County, Ill. He reports it to be a wild tree, about 10 inches in diameter and 40 feet high in 1908,[a] and as yielding about 1 bushel of nuts in that season. He has had the tree under observation for several years, having sent specimens of the nuts from it to the Department in various seasons since 1893. He has disseminated it in the form of nuts for planting under the names "Hodge's Favorite" and "Illinois Mammoth," neither of which, however, appears to have been published.

[a] Letters from H. G. Hodge, November 18 and 25, 1908.

DESCRIPTION.

Form oblong, obovate, compressed, tapering to a very prominent point at base, with a square-shouldered, quadrangular, sharp-pointed apex; surface rather lumpy and somewhat irregular; size variable, ranging from 60 to 100 per pound; color dull grayish brown, with numerous broad and long black stripes from apex to middle of nut; shell quite thick and hard but brittle, with thin and brittle partitions, cracking fairly well; kernel oblong, tapering, rather deeply grooved, but releasing the shell rather easily; color rather bright yellowish brown; texture moderately fine grained; flavor sweet, nutty; quality good.

This variety, which has not been previously published, is the largest one of northern origin yet brought to notice and is considered worthy of testing by those who desire to grow pecans near or above the northern limit of natural distribution of this species.

The specimens illustrated on Plate XLIX were from the original tree owned by Mr. H. G. Hodge, York, Ill.

BOLTON PECAN.

The original Bolton pecan tree appears to have been grown about 1888 from nuts obtained from an unnamed old tree on the Bolton plantation, about 7 miles[a] south of Monticello, Fla. The old plantation tree bore nuts of superior quality, which were largely planted throughout that section during the period which antedated the era of pecan budding and grafting. Out of the many seedlings thus grown from it in the vicinity of Monticello, one of six[b] in the garden of Judge T. M. Puleston, of that place, which he had secured from Mrs. E. Footman, of Monticello, began bearing at the age of 8 years. This soon thereafter attracted the attention of the late J. H. Girardeau, who named it "Bolton" and began propagating from it about 1899, in which year it was catalogued by him. Mr. Girardeau propagated from the old plantation tree and one or two other varieties largely for several years, having sold 10,000 grafted trees prior to 1904.[c] He exhibited the Bolton with others at the Charleston Exposition in 1902, and was awarded a gold medal thereon.

As scions taken from the old unnamed seedling tree on the Bolton plantation and young trees propagated therefrom appear to have been disseminated under the name "Bolton" during the earlier years of dissemination of the variety, it is strongly probable that two different

[a] Letter of Judge T. M. Puleston, January 26, 1909.

[b] Hume, in Florida Agricultural Experiment Station Bulletin 85, March, 1906, p. 496.

[c] Letters of J. H. Girardeau, sr., January 9, 1904, and J. H. Girardeau, jr., April 3 and 5, 1909.

varieties will be found under this name when the plantings already made come into bearing. So far as known, all the nursery-grown trees disseminated under the name "Bolton" during the past ten years trace to the Puleston tree, and this is considered the true Bolton.

DESCRIPTION.

Form short, broad, roundish oval, with broad, smooth base and blunt, quadrangular apex; size uniform, medium, 60 to 65 per pound; color grayish brown, with numerous black stripes toward apex; shell thick, with thick but soft partitions, cracking quite easily; kernel broad, plump, smooth, with broad, shallow grooves, brownish yellow, somewhat convoluted; texture rather soft, but fine grained; flavor sweet, nutty; quality good to very good.

Wood rather stout, straight, greenish to light gray, with inconspicuous dots and slender, rather blunt buds.

The largest crop yet harvested from the original tree was 50 pounds, but as it has been heavily cut for scions that is not considered a fair indication of the productiveness of the variety at its present age of 20 years.

Though apparently not as productive as some other varieties, this sort seems well adapted to the conditions of northern Florida and southern Georgia, where it is now in bearing.

The specimens illustrated on Plate XLIX were grown by Judge T. M. Puleston, Monticello, Fla.

CARMAN PECAN.

The original tree of the Carman pecan stands in the seedling orchard of Mr. S. H. James, Mound, La., which was grown from nuts planted by him in 1884.[a] It, with many others, was grown from nuts purchased by Mr. James at a fancy-fruit store in New Orleans, the exact source from which these nuts were obtained being unknown at the present time. The orchard in which the original tree stands is planted 30 by 60 feet, a distance entirely too close for rich alluvial soils such as it is located on, so that the development of the original Carman has been somewhat restricted by the crowding of adjacent trees. It began bearing at the age of 9 years from the seed and, next to "Moneymaker," which originated in the same orchard, Mr. James reports it as the most promising sort yet tested at his place.

Mr. James at first considered the Carman tree insufficiently vigorous for commercial planting, but, having increased his stock of the variety to 20 trees in his own orchard, beginning about 1897, he concludes that it is more vigorous than a number of other sorts, such as "Georgia," "Russell," and "Halbert," at his place.

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[a] Letter of S. H. James, January 22, 1909.

Mr. James named the variety "Carman" in 1898,[a] in honor of the late E. S. Carman, editor of the Rural New Yorker, and has sparingly propagated and disseminated the variety since that time.

DESCRIPTION.

Form very long, slender, and cylindrical, with rather smooth base and prominent quadrangular apex, sometimes distinctly curved; surface generally smooth, though distinctly ridged in some specimens; size large, 55 to 60 nuts per pound; color bright brownish, with few and narrow purplish stripes toward apex; shell medium in thickness but soft, with very soft partitions, cracking easily; kernel very long, slender, and smooth, not always filled at tips, but very smooth and attractive when plump; color bright golden; texture moderately fine grained and firm; flavor sweet, rich; quality good to very good. This is a dessert pecan for cracking at table, rather than for commercial crackers or the confectioner.

Tree a fairly strong grower; young wood rather stout, light grayish green, with rather numerous, inconspicuous, light brown dots. Buds, small, long, pointed.

No exact record of yield of the tree has been kept, but the original tree is considered fairly productive, the crop ripening about October 10. It is suggested for trial in the lower Mississippi Valley.

The specimens illustrated on Plate XLIX were grown by Mr. S. H. James, Mound, La.

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[a] S. H. James, in Rural New Yorker, January 8, 1898, p. 19.

APPENDIX.

ORGANIZATION OF THE DEPARTMENT OF AGRICULTURE.[a]

SECRETARY OF AGRICULTURE, James Wilson.

The Secretary exercises personal supervision of public business relating to the agricultural industry. He appoints all the officers and employees of the Department with the exception of the Assistant Secretary and the Chief of the Weather Bureau, who are appointed by the President, and directs the management of all the Bureaus, Divisions, and Offices embraced in the Department. He exercises advisory supervision over agricultural experiment stations which receive aid from the National Treasury, has control of the quarantine stations for imported cattle, of interstate quarantine rendered necessary by sheep and cattle diseases, and of the inspection of cattle-carrying vessels, and directs the inspection of domestic and imported food products, under the meat-inspection and pure-food laws. He is charged with the duty of issuing rules and regulations for the protection, maintenance, and care of the National Forests. He is also charged with carrying into effect the laws prohibiting the transportation by interstate commerce of game killed in violation of local laws, and excluding from importation certain noxious animals; and he has authority to control the importation of other animals.

ASSISTANT SECRETARY OF AGRICULTURE, Willet M. Hays.

The Assistant Secretary performs such duties as may be required by law or prescribed by the Secretary. He also becomes Acting Secretary of Agriculture in the absence of the Secretary.

SOLICITOR, George P. McCabe.

The Solicitor acts as the legal adviser of the Secretary, and is charged with the preparation and supervision of all legal papers to which the Department is a party, and of all communications to the Department of Justice and to the various officers thereof, including United States attorneys. He examines and approves, in advance of issue, all orders and regulations promulgated by the Secretary under statutory authority; represents the Department in all legal proceedings arising under the various laws intrusted to the Department for execution, and prosecutes applications of employees of the Department for patents. He is also a member of the Board of Food and Drug Inspection.

CHIEF CLERK, S. R. Burch.

The Chief Clerk has the general supervision of the clerks and employees; he is charged with the enforcement of the internal regulations of the Department; and is, by law, superintendent of the buildings occupied by the Department of Agriculture.

APPOINTMENT CLERK, Joseph B. Bennett.

The Appointment Clerk prepares all papers involved in the making of appointments, transfers, promotions, reductions, details, furloughs, and removals, for the entire Department, and decides all questions relating to the civil-service regulations affecting the same. He has charge of all correspondence of the Department with the Civil Service Commission, and of all certifications and communications issued by the Commission to the Department; and he reports to the Commission all appointments and other changes in the service. He keeps the personal records of all employees of the Department, and is custodian of their oaths of office and efficiency reports. He is also custodian of the Department seal.

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[a] The organization of the Department here given is in accordance with the act approved March 4, 1909, making appropriations for the fiscal year ending June 30, 1910, and shows changes in personnel to April 1, 1909.

CHIEF OF SUPPLY DIVISION, Cyrus B. Lower.

The Supply Division has charge of purchases of supplies and materials paid for from the general funds of the Department.

WEATHER BUREAU (corner Twenty-fourth and M streets NW.).—*Chief*, Willis L. Moore; *Assistant Chief*, Henry E. Williams; *Chief Clerk*, Daniel J. Carroll; *In charge of Climatological Division*, Frank H. Bigelow; *In charge of Instrument Division*, Charles F. Marvin; *In charge of Forecast Division*, Edward B. Garriott; *In charge of Special Research*, William J. Humphreys; *In charge of River and Flood Service, and Forecaster*, Harry C. Frankenfield; *In charge of Weather Bureau Accounts*, Edgar B. Calvert. *Chiefs of Division: Distributing*, James Berry; *Publications*, John P. Church; *Telegraph*, Jesse H. Robinson; *Marine Meteorology*, Henry L. Heiskell; *Supplies*, Robert Seyboth. *Librarian*, Charles F. Talman. *In charge of Forecast Districts:* Henry J. Cox, Chicago, Ill.; Alexander G. McAdie, San Francisco, Cal.; John W. Smith, Boston, Mass.; Edward A. Beals, Portland, Oreg.; Isaac M. Cline, New Orleans, La.; Frederick H. Brandenburg, Denver, Colo.; Ferdinand J. Walz, Louisville, Ky. *Inspectors:* Norman B. Conger, Detroit, Mich.; Henry B. Hersey, Milwaukee, Wis. *Research Staff, Mount Weather, Va.: In charge*, Alfred J. Henry; *In charge of Upper-Air Research*, William R. Blair; *In charge of Solar Radiation Research*, Herbert H. Kimball.

The Weather Bureau has charge of the forecasting of weather; the issue of storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce, and navigation; the gauging and reporting of river stages; the maintenance and operation of seacoast telegraph lines, and the collection and transmission of marine intelligence for the benefit of commerce and navigation; the reporting of temperature and rainfall conditions for the cotton, rice, sugar, and other interests; the display of frost and cold-wave signals; the distribution of meteorological information in the interests of agriculture and commerce; and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or are essential for the proper execution of the foregoing duties.

BUREAU OF ANIMAL INDUSTRY.—*Chief*, A. D. Melvin; *Assistant Chief*, A. M. Farrington; *Chief Clerk*, Charles C. Carroll; *Chief of Inspection Division*, Rice P. Steddom; *Chief of Quarantine Division*, Richard W. Hickman; *Chief of Pathological Division*, John R. Mohler; *Chief of Biochemic Division*, M. Dorset; *Chief of Dairy Division*, B. H. Rawl; *Chief of Division of Zoology*, B. H. Ransom; *Superintendent of Experiment Station*, E. C. Schroeder; *Animal Husbandman*, George M. Rommel; *Editor*, James M. Pickens.

The Bureau of Animal Industry has charge of the work of the Department relating to the live-stock industry. It conducts the inspection of live stock, meats, and meat food products intended for interstate or foreign commerce, under the act of Congress of June 30, 1906, and also has charge of the inspection of import and export animals, the inspection of ships for the transportation of export animals, and the quarantine stations for imported animals. It investigates the existence of communicable diseases of live stock, makes original scientific investigations as to the nature, cause, and prevention of such diseases, and takes measures for their repression and eradication, frequently in cooperation with State and Territorial authorities. The Bureau also makes investigations in the breeding and feeding of animals and in regard to dairy subjects; inspects and certifies dairy products for export, and supervises the manufacture of and interstate commerce in renovated butter. Reports of scientific investigations and treatises on various subjects relating to the live-stock industry are prepared and published.

BUREAU OF PLANT INDUSTRY.—*Physiologist and Pathologist, and Chief*, Beverly T. Galloway; *Physiologist and Pathologist, and Assistant Chief*, Albert F. Woods; *Chief Clerk*, James E. Jones; *Editor*, J. E. Rockwell; *Pathologist in charge of Laboratory of Plant Pathology*, Erwin F. Smith; *Pathologist in charge of Investigations of Fruit Diseases*, Merton B. Waite; *Pathologist in charge of Investigations in Forest Pathology*, Haven Metcalf; *Pathologist in charge of Cotton and Truck Diseases and Plant Disease Survey*, William A. Orton; *Mycologist in charge of Mycological Collections and Inspection Work*, Flora W. Patterson; *Physiologist in charge of Plant Life History Investigations*, Walter T. Swingle; *Physiologist in charge of Cotton Breeding Investigations*, Daniel N. Shoemaker; *In charge of Tobacco Investigations*, Archibald D. Shamel and Wightman W. Garner; *Physiologist in charge of Corn Investigations*, Charles P. Hartley; *Physiologist in charge of Alkali and Drought-Resistant Plant Breeding Investigations*, Thomas H. Kearney; *Physiologist in charge of Soil Bacteriology and Water Purification Investigations*, Karl F. Kellerman; *Bionomist in charge of Bionomic Inves-*

tigations of Tropical and Subtropical Plants, Orator F. Cook; *Physiologist in charge of Drug and Poisonous Plant and Tea Culture Investigations*, Rodney H. True; *Physicist in charge of Physical Laboratory*, Lyman J. Briggs; *Crop Technologist in charge of Agricultural Technology*, Nathan A. Cobb; *Botanist in charge of Taxonomic and Range Investigations*, Frederick V. Coville; *Agriculturist in charge of Farm Management*, William J. Spillman; *Cerealist in charge of Grain Investigations*, Mark Alfred Carleton; *Horticulturist in charge of Arlington Experimental Farm and Horticultural Investigations*, Lee C. Corbett; *Superintendent of Vegetable Testing Gardens*, William W. Tracy, sr.; *Pathologist in charge of Sugar-Beet Investigations*, Charles O. Townsend; *Agriculturist in charge of Western Agricultural Extension*, Carl S. Scofield; *Agriculturist in charge of Dry-Land Agriculture Investigations*, E. Channing Chilcott; *Pomologist in charge of Pomological Collections*, Gustavus B. Brackett; *Pomologists in charge of Field Investigations in Pomology*, William A. Taylor and G. Harold Powell; *Superintendent of Experimental Gardens and Grounds*, Edward M. Byrnes; *Agricultural Explorer in charge of Foreign Seed and Plant Introduction*, David Fairchild; *Agrostologist in charge of Forage Crop Investigations*, Charles V. Piper; *Botanist in charge of Seed Laboratory*, Edgar Brown; *Crop Technologist in charge of Grain Standardization*, John D. Shanahan; *Gardener in charge of Subtropical Garden, Miami, Fla.*, P. J. Wester; *Assistant Botanist in charge of Plant Introduction Garden, Chico, Cal.*, W. W. Tracy, jr.; *Pomologist in charge of South Texas Garden, Brownsville, Tex.*, Edward C. Green; *Special Agent in charge of Farmers' Cooperative Demonstration Work*, Seaman A. Knapp; *Assistant in charge of Seed Distribution*, Lisle Morrison.

The Bureau of Plant Industry studies plant life in all its relations to agriculture.

FOREST SERVICE (Atlantic Building, 928-930 F street NW.).—*Forester and Chief*, Gifford Pinchot; *Associate Forester*, Overton W. Price; *Law Officer*, P. P. Wells; *Editor*, Herbert A. Smith; *Dendrologist*, George B. Sudworth; *Branch of Operation, Assistant Forester in Charge*, James B. Adams; *Assistant*, Chas. S. Chapman; *Fiscal Agent*, H. B. Cramer; *Chief, Office of Occupancy*, M. J. McVean; *Chief, Office of Geography*, F. G. Plummer; *Chief, Office of Maintenance*, Geo. A. Bentley; *Branch of Silviculture, Assistant Forester in Charge*, William T. Cox; *Assistant*, E. E. Carter; *Chief, Office of Federal Cooperation*, A. B. Patterson; *Chief, Office of State and Private Cooperation*, J. G. Peters; *Chief, Office of Silvics*, Raphael Zon; *Branch of Grazing, Assistant Forester in Charge*, A. F. Potter; *Assistant*, L. F. Kneipp; *Branch of Products, Assistant Forester in Charge*, Wm. L. Hall; *Assistant*, McGarvey Cline; *Chief, Office of Wood Utilization*, H. S. Betts; *Chief, Office of Wood Preservation*, W. F. Sherfesee; *Chief, Office of Publication*, Findley Burns; *District 1, District Forester in Charge*, W. B. Greeley; *Assistant*, F. A. Silcox; *District Law Officer*, W. M. Aiken; *Chief, Office of Operation*, R. H. Rutledge; *Assistant*, R. Y. Stuart; *Chief, Office of Silviculture*, A. W. Cooper; *Assistant*, D. T. Mason; *Chief, Office of Grazing*, C. H. Adams; *Assistant*, W. S. Perrine; *Chief, Office of Products*, P. R. Hicks; *Assistant*, F. I. Rockwell; *District 2, District Forester in Charge*, Smith Riley; *Assistant*, P. G. Redington; *District Law Officer*, J. M. Cates; *Chief, Office of Operation*, Fred W. Morrell; *Assistant*, C. J. Stahl; *Chief, Office of Silviculture*, A. K. Chittenden; *Assistant*, S. L. Moore; *Chief, Office of Grazing*, J. W. Nelson; *Assistant*, E. N. Kavanagh; *Chief, Office of Products*, C. L. Hill; *Assistant*, H. B. Holroyd; *District 3, District Forester in Charge*, A. C. Ringland; *Assistant*, E. H. Clapp; *District Law Officer*, H. B. Jamison; *Chief, Office of Operation*, A. O. Waha; *Assistant*, R. G. Willson; *Chief, Office of Silviculture*, T. S. Woolsey, jr.; *Assistant*, A. B. Recknagel; *Chief, Office of Grazing*, J. K. Campbell; *Assistant*, John Kerr; *Chief, Office of Products*, O. T. Swan; *District 4, District Forester in Charge*, Clyde Leavitt; *Assistant*, Franklin W. Reed; *District Law Officer*, W. C. Henderson; *Chief, Office of Operation*, R. P. Imes; *Assistant*, E. H. Clarke; *Chief, Office of Silviculture*, L. L. White; *Assistant*, O. M. Butler; *Chief, Office of Grazing*, Homer E. Fenn; *Assistant*, A. C. McCain; *Chief, Office of Products*, A. L. Brown; *District 5, District Forester in Charge*, F. E. Olmsted; *Assistant*, Coert DuBois; *District Law Officer*, E. A. Lane; *Chief, Office of Operation*, R. L. Fromme; *Assistant*, Roy Headley; *Chief, Office of Silviculture*, G. M. Homans; *Assistant*, T. D. Woodbury; *Chief, Office of Grazing*, John H. Hatton; *Assistant*, M. B. Elliott; *Chief, Office of Products*, C. S. Smith; *District 6, District Forester in Charge*, E. T. Allen; *Assistant*, Geo. H. Cecil; *District Law Officer*, C. R. Pierce; *Chief, Office of Operation*, C. H. Flory; *Assistant*, C. J. Buck; *Chief, Office of Silviculture*, F. E. Ames; *Assistant*, C. S. Judd; *Chief, Office of Grazing*, Howard K. O'Brien; *Assistant*, T. P. McKenzie; *Chief, Office of Products*, J. B. Knapp; *Assistant*, H. B. Oakleaf.

The Forest Service has charge of the administration of the National Forests, and conducts examinations on the public lands to determine the propriety of making changes in the boundaries of existing National Forests and of withdrawing other areas suitable

for new forests; gives practical advice in the conservative handling of State and private forest lands; investigates methods of planting and kinds of trees for planting, and gives practical advice to tree planters; studies commercially valuable trees to determine the best means of using and reproducing them; tests the strength and durability of construction timbers, railroad ties, and poles, and determines the best methods of extending their life through preservative treatment; and studies forest fires, the effects of grazing on forest land, turpentine orcharding, and other forest problems.

Bureau of Chemistry (corner of Fourteenth and B streets SW.).—*Chemist and Chief of Bureau*, H. W. Wiley; *Associate Chemist*, F. L. Dunlap; *Assistant Chief of Bureau*, W. D. Bigelow; *Chief Clerk*, F. B. Linton; *Editorial Clerk*, A. L. Pierce; *Librarian*, M. W. Taylor; *Chief of Division of Foods*, W. D. Bigelow; *Chief of Food Inspection Laboratory*, L. M. Tolman; *Chief of Food Technology Laboratory and Assistant Chief of Division*, E. M. Chace; *Chief of Oil, Fat, and Wax Laboratory*, [not yet appointed]. *Chief of Division of Drugs*, L. F. Kebler; *Chief of Drug Inspection Laboratory*, G. W. Hoover; *Chief of Synthetic Products Laboratory*, W. O. Emery; *Chief of Essential Oils Laboratory*, [not yet appointed]; *Acting Chief of Pharmacological Laboratory*, Wm. Salant. *Chief Food and Drug Inspector*, W. G. Campbell. *Chief of Miscellaneous Division*, J. K. Haywood; *Chief of Water Laboratory*, W. W. Skinner; *Chief of Cattle Food and Grain Laboratory*, F. J. Fuller; *Chief of Insecticide and Fungicide Laboratory*, C. C. McDonnell; *Chief of Trade Wastes Laboratory*, Division Chief; *Chief of Contracts Laboratory*, P. H. Walker; *Chief of Dairy Laboratory*, G. E. Patrick; *Chief of Food Research Laboratory*, M. E. Pennington; *Chief of Leather and Paper Laboratory*, F. P. Veitch; *Chief of Microchemical Laboratory*, B. J. Howard; *Acting Chief of Sugar Laboratory*, A. H. Bryan; *In charge of Nitrogen Section*, T. C. Trescot. Special Investigations: *Animal Physiological Chemistry*, F. C. Weber, *In charge*; *Vegetable Physiological Chemistry*, J. A. LeClerc, *In charge; Bacteriological Chemistry*, G. W. Stiles, *In charge; Enological Chemistry*, W. B. Alwood, *In charge*. Food and Drug Inspection Laboratories: *Chiefs*, Boston, B. H. Smith; Buffalo, W. L. Dubois, *Acting;* Chicago, A. L. Winton; Cincinnati, B. R. Hart, *Acting;* Denver, A. E. Leach; Detroit, H. L. Schulz, *Acting;* Galveston, T. F. Pappe, *Acting;* Honolulu, Hawaiian Islands, R. A. Duncan, *Acting;* Kansas City, Mo., A. V. H. Mory, *Acting;* Nashville, [not yet appointed]; New Orleans, C. W. Harrison; New York, R. E. Doolittle; Omaha, S. H. Ross, *Acting;* Philadelphia, C. S. Brinton; Pittsburg, M. C. Albrech, *Acting;* Portland, Oreg., A. L. Knisely, *Acting*; St. Louis, D. B. Bisbee, *Acting;* St. Paul, A. S. Mitchell; San Francisco, R. A. Gould; Savannah, W. C. Burnet, *Acting;* Seattle, H. M. Loomis, *Acting*.

The Bureau of Chemistry investigates methods proposed for the analysis of plants, fertilizers, and agricultural products, and makes such analyses as pertain in general to the interests of agriculture. The work on foods includes the analysis of adulterated products, experiments to determine the effect of adulterants on the human organism, experiments in the preparation of food products without preservatives, and allied investigations rendered necessary by the enforcement of the food and drugs act, the examination of food products imported into the United States, and of domestic foods and drugs in accordance with the food and drugs act, June 30, 1906. A corps of 35 inspectors directed by a chief inspector at Washington collects samples for examination and inspects factories. The Bureau makes chemical analyses for other Bureaus and Divisions of the Department, and for other Departments of the Government which apply to the Secretary of Agriculture for such assistance, especially in the examination of supplies delivered under contract.

Bureau of Soils.—*Chief*, Milton Whitney; *Chief Clerk*, A. G. Rice; *In charge of Soil Laboratories*, Frank K. Cameron; *In charge of Soil Survey, Eastern Division*, Jay A. Bonsteel; *In charge of Soil Survey, Western Division*, Clarence W. Dorsey; *In charge of Soil Management*, Frank D. Gardner; *In charge of Fertility Investigations*, Oswald Schreiner; *In charge of Soil Erosion Investigations*, W J McGee.

The Bureau of Soils is intrusted with the investigation, survey, and mapping of soils; the investigation of the cause and prevention of the rise of alkali in the soil, and the drainage of soils.

Bureau of Entomology.—*Entomologist and Chief*, L. O. Howard; *Entomologist and Acting Chief in absence of Chief*, C. L. Marlatt; *Executive Assistant*, R. S. Clifton; *Chief Clerk*, C. J. Gillis; *In charge of Truck Crop and Special Insect Investigations*, F. H. Chittenden; *In charge of Forest Insect Investigations*, A. D. Hopkins; *In charge of Southern Field Crop Insect and Tick Investigations*, W. D. Hunter; *In charge*

of Cereal and Forage Plant Insect Investigations, F. M. Webster; *In charge of Deciduous Fruit Insect Investigations*, A. L. Quaintance; *In charge of Apiculture*, E. F. Phillips; *In charge of Gipsy Moth and Brown-tail Moth Field Work*, D. M. Rogers; *In charge of White Fly Investigations*, A. W. Morrill; *In charge of Gipsy Moth Laboratory*, W. F. Fiske; *In charge of Cattle Tick Life History Investigations*, F. C. Bishopp; *In charge of Tobacco Insect Investigations*, A. C. Morgan; *In charge of Hydrocyanic Acid Gas Investigations*, R. S. Woglum; *In charge of Editorial Work*, R. P. Currie; *Librarian*, Mabel Colcord.

The Bureau of Entomology obtains and disseminates information regarding injurious insects affecting field crops, fruits, small fruits, truck crops, forests and forest products, and stored products; studies insects in relation to diseases of man and other animals and as animal parasites; experiments with the introduction of beneficial insects and with the fungous and other diseases of insects; and conducts experiments and tests with insecticides and insecticide machinery. It is further charged with investigations in apiculture. The information gained is disseminated in the form of general reports, bulletins, and circulars. Museum work is done in connection with the Division of Insects of the National Museum, and insects are identified for experiment stations and other public institutions and for private individuals.

BUREAU OF BIOLOGICAL SURVEY.—*Biologist and Chief*, C. Hart Merriam; *Administrative Assistant and Acting Chief in absence of Chief*, H. W. Henshaw; *Assistant in charge of Economic Investigations*, A. K. Fisher; *Assistant in charge of Game Preservation*, T. S. Palmer; *Assistant in charge of Geographic Distribution*, Vernon Bailey.

The Bureau of Biological Survey studies the geographic distribution of animals and plants, and maps the natural life zones of the country; it also investigates the economic relations of birds and mammals, and recommends measures for the preservation of beneficial and the destruction of injurious species. It is charged with carrying into effect the provisions of the Federal law for the supervision of interstate commerce in game and the importation and protection of birds, and certain provisions of the law for the protection of game in Alaska. It has charge of the Montana National Bison Range and other National reservations for birds and mammals.

DIVISION OF ACCOUNTS AND DISBURSEMENTS.—*Chief and Disbursing Clerk*, A. Zappone; *Assistant Chief, in charge of Weather Bureau Section*, Edgar B. Calvert; *Cashier and Chief Clerk*, M. E. Fagan; *Bookkeeper*, F. W. Legge; *Auditor in charge of Miscellaneous Section*, W. J. Nevius; *Auditor in charge of Auditing Section A*, Everett D. Yerby; *Auditor in charge of Auditing Section B*, A. W. Smith; *Auditor in charge of Freight and Transportation Section*, E. E. Forbes.

The Division of Accounts and Disbursements audits, adjusts, and pays all accounts and claims against the Department; decides questions involving the expenditure of public funds; prepares advertisements and schedules for annual supplies, and letters of authority; writes, for the signature of the Secretary, all letters to the Treasury Department pertaining to fiscal matters; examines and signs requisitions for the purchase of supplies; issues bills of lading and requests for passenger and freight transportation; prepares the annual estimates of appropriations; prepares annual fiscal reports to Congress, and transacts all other business relating to the financial interests of the Department.

DIVISION OF PUBLICATIONS.—*Editor and Chief*, Jos. A. Arnold; *Editor and Assistant Chief*, B. D. Stallings; *Chief Clerk*, A. I. Mudd; *Associate Editor*, Geo. Wm. Hill; *Assistant in charge of Document Section*, R. B. Handy; *Assistant in charge of Indexing*, Charles H. Greathouse; *Assistant in charge of Illustrations*, Louis S. Williams.

The Division of Publications is charged with the supervision of the publication, printing, indexing, and illustration work of the Department. It edits, prepares for the printer, and reads the proof of all the bulletins, reports, circulars, blanks, blank books, etc., ordered for the various bureaus, divisions, and offices, with the exception of those of the Weather Bureau, and keeps the official record of all expenditures for printing and binding. It has immediate charge of the Yearbook and Farmers' Bulletins and controls the general printing fund, and conducts all correspondence with the Government Printing Office. It issues, in the form of press notices, official information of interest to agriculturists, and distributes to agricultural publications and to newspaper correspondents notices and synopses of Department publications. It distributes all publications issued by the Department, excepting those of the Weather Bureau and those turned over by law to the Superintendent of Documents for sale at prices fixed by him.

BUREAU OF STATISTICS.—*Statistician and Chief*, Victor H. Olmsted; *Associate Statistician*, C. C. Clark; *Assistant Statistician*, Nat C. Murray; *Chief Clerk*, S. A. Jones; *Chief of Division of Foreign Markets*, George K. Holmes; *Chief of Division of Domestic Crop Reports*, F. J. Blair; *Chief of Editorial Division and Library*, Chas. M. Daugherty; *Crop Reporting Board:* Victor H. Olmsted, Charles C. Clark, Nat C. Murray, George K. Holmes, and one member selected from month to month from the corps of field agents and of State statistical agents.

The Statistician collects information as to the condition, production, etc., of the principal crops and the status of farm animals through State agents, each of whom is assisted by a corps of local reporters, through separate corps of county, township, and cotton correspondents, through traveling agents, and through a special foreign correspondent, assisted by consular, agricultural, and commercial authorities. He records, tabulates, and coordinates statistics of agricultural production, distribution, and consumption, the authorized data of governments, institutes, societies, boards of trade, and individual experts; prepares special statistical bulletins upon domestic and foreign agricultural subjects, and issues a monthly crop report for the information of producers and consumers. Special bulletins are published giving information of domestic and foreign trade and of the conditions under which foreign trade may be extended. Investigations are made of land tenures, cost of producing farm products, country-life education, transportation, and other lines of rural economics.

The Bureau of Statistics collects information regarding area, condition, yield, value, and allied data relating to crops; also regarding the number, value, and status of farm animals. The agencies through which these data are collected are special field agents, State agents, county correspondents, township correspondents, and special lists of correspondents; similar information relating to foreign countries is obtained through consular, agricultural, and commercial authorities. The Bureau records, tabulates, and coordinates agricultural statistics from the authorized data of Governments, institutes, societies, boards of trade, and individual experts, and makes special investigations upon subjects relating to domestic and foreign agricultural production and consumption, supply and demand, values, and transportation. The information collected is disseminated through bulletins, circulars, and special reports. An agricultural statistical publication, the "Crop Reporter," is issued monthly for general distribution.

LIBRARY.—*Librarian*, Claribel R. Barnett; *Assistant Librarian*, Emma B. Hawks.

The Librarian has charge of the Library and supervises the arrangement and cataloguing of books, the preparation of bibliographies and similar publications, and the purchase of books, The mailing lists for the distribution of Department publications to foreign countries are under the supervision of the Librarian.

OFFICE OF EXPERIMENT STATIONS.—*Director*, A. C. True; *Assistant Director and Editor of Experiment Station Record*, E. W. Allen; *Chief of Editorial Division*, W. H. Beal; *Chief of Division of Insular Stations*, W. H. Evans; *Special Agent, Alaska*, C. C. Georgeson; *Special Agent, Hawaii*, E. V. Wilcox; *Special Agent, Porto Rico*, D. W. May; *Special Agent, Guam*, H. L. Costenoble; *Expert in Nutrition Investigations*, C. F. Langworthy; *Chief of Irrigation Investigations*, S. Fortier; *Chief of Drainage Investigations*, C. G. Elliott; *Farmers' Institute Specialist*, John Hamilton; *Expert in Agricultural Education*, D. J. Crosby; *Chief Clerk*, Mrs. C. E. Johnston.

The Office of Experiment Stations represents the Department in its relation with the experiment stations, which are now in operation in all the States and Territories, and directly manages the experiment stations in Alaska, Porto Rico, and Hawaii. It seeks to promote the interests of agricultural education and investigation throughout the United States. It collects and disseminates general information regarding agricultural schools, colleges, and stations, and publishes accounts of agricultural investigations at home and abroad. It also indicates lines of inquiry for the stations, aids in the conduct of cooperative experiments, reports upon their expenditures and work, and in general furnishes them with such advice and assistance as will best promote the purposes for which they were established. In a similar way it aids in the development of the farmers' institutes throughout the United States. It conducts investigations on the laws and institutions relating to irrigation in different regions, the use of irrigation waters in agriculture, the removal of seepage and surplus waters by drainage, and the use of different kinds of power and appliances for irrigation and drainage.

OFFICE OF PUBLIC ROADS.—*Director*, Logan Waller Page; *Assistant Director*, Allerton S. Cushman; *Chief Engineer*, Vernon M. Peirce; *Chief of Road Management*, James Edmund Pennybacker, jr.; *Chief of Records and Chief Clerk*, W. Carl Wyatt; *Testing Engineer*, Philip L. Wormeley.

The Office of Public Roads collects and disseminates information concerning systems of road management throughout the United States; conducts investigations and experiments regarding road-building materials and methods of road construction; makes chemical and physical tests of road materials and materials of construction relating to agriculture; gives expert advice on road administration and road construction; demonstrates the best methods of construction, and prepares publications on these subjects.

APPROPRIATIONS FOR THE DEPARTMENT OF AGRICULTURE FOR THE FISCAL YEARS ENDING JUNE 30, 1907, 1908, AND 1909.

[It is to be noticed that this table has been changed in arrangement of items as compared with the similar tables in previous Yearbooks.]

Object of appropriation.	1907.	1908.	1909.
Salaries, statutory	$1,606,870.00	$1,725,230.00	$1,820,820.00
Weather Bureau, general expenses	650,000.00	665,000.00	873,000.00
Buildings	53,000.00		
Animal Industry Bureau, general expenses	837,200.00	897,200.00	1,247,200.00
Meat inspection	3,000,000.00	3,000,000.00	3,000,000.00
Cattle-tick eradication	107,500.00	135,811.90	250,000.00
Animal breeding and feeding	25,000.00	50,000.00	50,000.00
Plant Industry Bureau, general expenses [a]	502,301.28	586,559.40	947,034.12
Purchase and distribution of seeds	242,920.00	288,000.00	258,000.00
Cotton boll-weevil investigations	145,000.00	145,632.42	
Paper tests			10,000.00
Grain investigations	15,000.00	40,000.00	
Forest Service, general expenses	908,550.25	1,785,779.97	3,151,900.00
National forests, administration, etc	1,050,000.00	1,666,709.15	600,000.00
Naval stores industry			10,000.00
National Bison Range			43,000.00
Wichita Forest and Game Preserve	15,000.00		
Appalachian survey and report	25,000.00	[b] 23,403.76	
Chemistry Bureau, laboratory	395,920.00	650,000.00	860,000.00
Soil investigations	185,000.00	170,000.00	200,000.00
Entomology Bureau, general expenses	75,000.00	113,800.00	158,800.00
Moth investigations	232,500.00	141,407.27	250,000.00
Cotton boll weevil investigations	85,000.00	40,000.00	
Biological Survey Bureau	44,420.00	44,420.00	54,420.00
Publications, Department of Agriculture [c]	432,250.00	468,750.00	500,000.00
Collecting agricultural statistics	112,900.00	122,900.00	125,000.00
Library	10,000.00	12,500.00	15,500.00
Contingent expenses	37,000.00	47,000.00	86,200.00
Agricultural experiment stations (for stations under Hatch and Adams acts: $1,056,000 in 1907; $1,152,000 in 1908; $1,248,000 in 1909) [d]	83,565.15	107,065.15	123,000.00
Nutrition investigations	20,000.00	5,000.00	7,000.00
Irrigation investigations	122,200.00	150,000.00	150,000.00
Public road inquiries	57,660.00	57,660.00	75,000.00
Building, Department of Agriculture	780,934.68	495,340.07	30,294.33
Total	11,857,691.36	13,635,169.09	14,896,168.45

[a] Sums from sale of fruits and vegetables included as follows: $3,541.28 in 1907; $1,779.40 in 1908, and $768.12 in 1909.
[b] Unexpended balance from 1907.
[c] General printing fund included.
[d] Sum from sale of card indexes included in 1907 and expended in 1908 is $65.15.

AGRICULTURAL COLLEGES AND OTHER INSTITUTIONS IN THE UNITED STATES HAVING COURSES IN AGRICULTURE.[a]

College instruction in agriculture is given in the colleges and universities receiving the benefits of the acts of Congress of July 2, 1862, August 30, 1890, and March 4, 1907, which are now in operation in all the States and Territories, except Alaska. The total number of these institutions is 67, of which 64 maintain courses of instruction in agriculture. In 22 States the agricultural colleges are departments of the State universities. In 15 States and Territories separate institutions having courses in agriculture are maintained for the colored race. All of the agricultural colleges for white persons and several of those for negroes offer four-year courses in agriculture and its related sciences leading to bachelors' degrees, and many provide for graduate study. About 50 of these institutions also provide special, short, and correspondence courses

[a] Including only institutions established under the land-grant act of July 2, 1862.

in the different branches of agriculture, including agronomy, horticulture, animal husbandry, poultry raising, cheese making, dairying, sugar making, rural engineering, farm mechanics, and other technical subjects. The officers of the agricultural colleges engage quite largely in conducting farmers' institutes and various other forms of college extension. The agricultural experiment stations with very few exceptions are departments of the agricultural colleges. The total number of persons engaged in the work of education and research in the land-grant colleges and the experiment stations in 1908 was 6,555; the number of students in these colleges, 73,857; the number of students (white) in the four-year college courses in agriculture, 4,354; in short and special courses, 7,203. There were also 2,336 students in agriculture in the separate institutions for negroes. With a few exceptions, each of these colleges offers free tuition to residents of the State in which it is located. In the excepted cases scholarships are open to promising and energetic students; and, in all, opportunities are found for some to earn part of their expenses by their own labor. The expenses are from $125 to $300 for the school year.

Agricultural colleges and other institutions in the United States having courses in agriculture.

State or Territory.	Name of institution.	Location.	President.
Alabama	Alabama Polytechnical Institute	Auburn	C. C. Thach.
	Agricultural School of the Tuskegee Normal and Industrial Institute.	Tuskegee Institute	B. T. Washington.
	Agricultural and Mechanical College for Negroes.	Normal	W. H. Councill.
Arizona	University of Arizona	Tucson	K. C. Babcock.
Arkansas	University of Arkansas	Fayetteville	J. N. Tillman.
	Branch Normal College [a]	Pine Bluff	Isaac Fisher.
California	University of California	Berkeley	B. I. Wheeler.
Colorado	The State Agricultural College of Colorado.	Fort Collins	B. O. Aylesworth.
Connecticut	Connecticut Agricultural College	Storrs	C. L. Beach.
Delaware	Delaware College	Newark	G. A. Harter.
	State College for Colored Students	Dover	W. C. Jason.
Florida	University of the State of Florida	Gainesville	Andrew Sledd.
	Florida State Normal and Industrial School.	Tallahassee	N. B. Young.
Georgia	Georgia State College of Agriculture.	Athens	A. M. Soule.
	Georgia State Industrial College [a]	Savannah	R. R. Wright.
Hawaii	College of Hawaii	Honolulu	J. W. Gilmore.
Idaho	University of Idaho	Moscow	J. A. MacLean.
Illinois	University of Illinois	Urbana	E. J. James.
Indiana	Purdue University	Lafayette	W. E. Stone.
Iowa	Iowa State College of Agriculture and Mechanic Arts.	Ames	A. B. Storms.
Kansas	Kansas State Agricultural College	Manhattan	E. R. Nichols.
Kentucky	State University	Lexington	J. K. Patterson.
	The Kentucky Normal and Industrial Institute for Colored Persons.	Frankfort	J H. Jackson.
Louisiana	Louisiana State University and Agricultural and Mechanical College.	Baton Rouge	T. D. Boyd.
	Southern University and Agricultural and Mechanical College.	New Orleans	H. A. Hill.
Maine	The University of Maine	Orono	G. E. Fellows.
Maryland	Maryland Agricultural College	College Park	R. W. Silvester.
	Princess Anne Academy, Eastern Branch of the Maryland Agricultural College.	Princess Anne	F. Trigg.
Massachusetts	Massachusetts Agricultural College.	Amherst	K. L. Butterfield.
	Massachusetts Institute of Technology.[b]	Boston	R. C. Maclaurin.
Michigan	Michigan State Agricultural College.	East Lansing	J. L. Snyder.
Minnesota	The University of Minnesota	Minneapolis	C. Northrop.
Mississippi	Mississippi Agricultural and Mechanical College.	Agricultural College	J. C. Hardy.
	Alcorn Agricultural and Mechanical College.	Alcorn	L. J. Rowan.
Missouri	College of Agriculture and Mechanic Arts of the University of Missouri.	Columbia	A. R. Hill.
	School of Mines and Metallurgy of the University of Missouri.[a]	Rolla	L. E. Young.[b]
	Lincoln Institute	Jefferson	B. F. Allen.
Montana	Montana Agricultural College	Bozeman	Jas. M. Hamilton.

[a] Does not maintain courses in agriculture. [b] Director.

Agricultural colleges and other institutions in the United States having courses in agriculture—Continued.

State or Territory.	Name of institution.	Location.	President.
Nebraska	Industrial College of the University of Nebraska.	Lincoln	Samuel Avery.[a]
Nevada	University of Nevada	Reno	J. E. Stubbs.
New Hampshire	New Hampshire College of Agriculture and the Mechanic Arts.	Durham	W. D. Gibbs.
New Jersey	Rutgers Scientific School (The New Jersey State College for the Benefit of Agriculture and the Mechanic Arts.)	New Brunswick	W. H. S. Demarest.
New Mexico	New Mexico College of Agriculture and Mechanic Arts.	Agricultural College	W. E. Garrison.
New York	New York State College of Agriculture at Cornell University.	Ithaca	L. H. Bailey.[b]
North Carolina	The North Carolina College of Agriculture and Mechanic Arts.	West Raleigh	D. H. Hill.
	The Agricultural and Mechanical College for the Colored Race.	Greensboro	J. B. Dudley.
North Dakota	North Dakota Agricultural College.	Agricultural College	J. H. Worst.
Ohio	Ohio State University	Columbus	W. O. Thompson.
Oklahoma	Oklahoma Agricultural and Mechanical College.	Stillwater	J. H. Connell.
	Agricultural and Normal University.	Langston	I. E. Page.
Oregon	Oregon State Agricultural College.	Corvallis	W. J. Kerr.
Pennsylvania	The Pennsylvania State College	State College	E. E. Sparks.
Porto Rico	University of Porto Rico	San Juan	E. G. Dexter.
Rhode Island	Rhode Island College of Agriculture and Mechanic Arts.	Kingston	Howard Edwards.
South Carolina	The Clemson Agricultural College of South Carolina.	Clemson College	P. H. Mell.
	The Colored Normal, Industrial, Agricultural, and Mechanical College of South Carolina.	Orangeburg	T. E. Miller.
South Dakota	South Dakota State College of Agriculture and Mechanic Arts.	Brookings	Robert L. Slagle.
Tennessee	University of Tennessee	Knoxville	Brown Ayres.
Texas	Agricultural and Mechanical College of Texas.	College Station	R. T. Milner.
	Prairie View State Normal and Industrial College.	Prairie View	E. L. Blackshear.
Utah	The Agricultural College of Utah	Logan	J. A. Widtsoe.
Vermont	University of Vermont and State Agricultural College.	Burlington	M. H. Buckham.
Virginia	The Virginia Agricultural and Mechanical College and Polytechnic Institute.	Blacksburg	P. B. Barringer.
	The Hampton Normal and Agricultural Institute.	Hampton	H. B. Frissell.
Washington	State College of Washington	Pullman	E. A. Bryan.
West Virginia	West Virginia University	Morgantown	D. B. Purinton.
	The West Virginia Colored Institute.	Institute	J. McH. Jones.
Wisconsin	University of Wisconsin	Madison	Chas. R. Van Hise.
Wyoming	University of Wyoming	Laramie	C. O. Merica.

[a] Acting chancellor. [b] Director.

AGRICULTURAL EXPERIMENT STATIONS OF THE UNITED STATES, THEIR LOCATIONS, DIRECTORS, AND PRINCIPAL LINES OF WORK.

Station, location, and director.	Principal lines of work.
Alabama (College), Auburn: J. F. Duggar	Field experiments; plant breeding; soil improvement; feeding experiments; entomology; diseases of plants and animals; analysis of fertilizers.
Alabama (Canebrake), Uniontown: F. D. Stevens	Agronomy; horticulture; plant breeding; diseases of plants.
Alabama (Tuskegee), Tuskegee Institute: G. W. Carver	Agronomy; horticulture; diseases of plants; animal industry; poultry investigations; dairying.
Alaska, Sitka (Copper Center, Rampart, Kadiak, and Fairbanks): C. C. Georgeson[a]	Agronomy; plant introduction; plant breeding; horticulture animal husbandry; dairying; meteorology.

[a] Special agent in charge.

Agricultural experiment stations of the United States, their locations, directors, and principal lines of work—Continued.

Station, location, and director.	Principal lines of work.
Arizona, Tucson: R. H. Forbes	Chemistry; botany; agronomy; horticulture; improvement of ranges; sheep-breeding experiments; plant diseases; irrigation.
Arkansas, Fayetteville: C. F. Adams[a]	Chemistry; soil physics; agronomy; horitculture; plant breeding; diseases of plants; animal husbandry and pathology; dairying; entomology; poultry experiments; nursery inspection.
California, Berkeley: E. J. Wickson	Chemistry; soils; bacteriology; fertilizer control; agronomy; horticulture, including viticulture and zymology; botany; meteorology; entomology; animal husbandry; dairying; poultry experiments; irrigation and drainage; silviculture; reclamation of alkali lands; animal and plant pathology; nutrition investigations.
Colorado, Fort Collins: L. G. Carpenter	Chemistry; meteorology; agronomy; horticulture; forestry; plant breeding; diseases of plants; animal husbandry; veterinary investigations; entomology; bacteriology; irrigation.
Connecticut (State), New Haven: E. H. Jenkins	Chemistry; inspection of fertilizers, foods, drugs, feeding stuffs, Babcock test apparatus, and nurseries; diseases of plants; plant breeding; seed testing; forestry; agronomy; entomology; investigation of vegetable proteids.
Connecticut (Storrs), Storrs: L. A. Clinton	Dairy bacteriology; agronomy; horticulture; animal husbandry; poultry culture; dairying; embryology.
Delaware, Newark: Harry Hayward	Chemistry; agronomy; horticulture; plant breeding; diseases of plants and animals; animal husbandry; entomology.
Florida, Gainesville: P. H. Rolfs	Chemistry; agronomy; horticulture; plant physiology; diseases of plants; feeding experiments; entomology.
Georgia, Experiment: M. V. Calvin	Chemistry; agronomy; bacteriology; horticulture; plant breeding; plant diseases; entomology; animal husbandry; dairying.
Guam:[b] H. L. V. Costenoble[c]	Plant and animal introduction and breeding; agronomy; horticulture; apiculture; control of plant diseases and insect pests.
Hawaii (Federal), Honolulu: E. V. Wilcox[a]	Chemistry; analysis of soil and feeding stuffs; agronomy; horticulture; packing and shipping of tropical fruits; plant breeding; entomology; apiculture; sericulture; rubber investigations; rice and cotton investigations.
Hawaii (Sugar Planters'), Honolulu: C. F. Eckart	Breeding, culture, diseases, and insect pests of sugar cane; sugar manufacture.
Idaho, Moscow: H. T. French	Chemistry; agronomy; horticulture; plant breeding; diseases of plants; entomology; animal husbandry; irrigation; dairying; dry farming; wheat investigations; fruit by-products.
Illinois. Urbana: E. Davenport	Chemistry; soil physics; bacteriology; agronomy; horticulture, forestry; plant breeding; diseases of plants and animals; animal husbandry; dairying; entomology.
Indiana, Lafayette: Arthur Goss	Chemistry; soils; agronomy; horticulture; plant breeding; feeding stuff and fertilizer control; animal husbandry; dairying diseases of plants and animals; entomology; agricultural extension work.
Iowa, Ames: C. F. Curtiss	Chemistry; botany; agronomy; horticulture; plant breeding; forestry; diseases of plants; animal husbandry; poultry investigations; dairying; entomology; rural engineering; good roads investigations.
Kansas, Manhattan: E. H. Webster	Soils; inspection of feeding stuffs and fertilizers; milling and baking tests; horticulture; plant breeding; agronomy; animal husbandry; poultry experiments; diseases of animals; dairying; entomology; extermination of prairie dogs and gophers; irrigation.
Kentucky, Lexington: M. A. Scovell	Chemistry; soils; bacteriology; inspection of fertilizers, foods, feeding stuffs, orchards, and nurseries; agronomy; horticulture; plant breeding; animal husbandry; dairying; diseases of plants and animals; entomology; apiculture.
Louisiana (Sugar), New Orleans: W. R. Dodson	Chemistry; bacteriology; soils; agronomy; horticulture; sugar making; drainage; irrigation.

[a] Acting director. [b] Address: Island of Guam, via San Francisco. [c] Special agent in charge.

Agricultural experiment stations of the United States, their locations, directors, and principal lines of work—Continued.

Station, location, and director.	Principal lines of work.
Louisiana (State), Baton Rouge: W. R. Dodson	Geology; botany; bacteriology; soils; inspection of fertilizers, feeding stuffs, and Paris green; agronomy; horticulture; fertilizer and variety tests with rice; animal husbandry; diseases of animals; entomology.
Louisiana (North), Calhoun: W. R. Dodson	Chemistry; soils; fertilizers; agronomy; horticulture; animal husbandry; stock raising; poultry experiments; dairying.
Maine, Orono: C. D. Woods	Chemistry; botany; inspection of foods, fertilizers, commercial feeding stuffs, and seeds; calibration of creamery glassware; vegetable pathology; biology, including poultry breeding; plant breeding; entomology.
Maryland College Park: H. J. Patterson	Chemistry; fertilizers; agronomy; horticulture; plant breeding; diseases of plants and animals; breeding of plants; animal husbandry; poultry experiments; dairying; entomology.
Massachusetts, Amherst: W. P. Brooks	Chemistry; meteorology; analysis and inspection of fertilizers and commercial feeding stuffs; inspection of creamery glassware and nurseries; agronomy; horticulture; plant breeding; diseases of plants and animals; animal husbandry; dairying; entomology; effect of electricity on plant growth.
Michigan, East Lansing: R. S. Shaw	Chemistry; analysis and control of fertilizers; bacteriology; agronomy; horticulture; forestry; plant breeding; diseases of plants and animals; animal husbandry; stable hygiene; poultry culture; entomology.
Minnesota, St. Anthony Park, St. Paul: J. W. Olsen	Chemistry; soils; fertilizers; agronomy; horticulture; forestry; diseases of plants and animals; food and nutrition investigations; plant breeding; animal husbandry; dairying; entomology; farm management; ventilation; farm statistics.
Mississippi, Agricultural College: W. L. Hutchinson	Fertilizers; agronomy; horticulture; biology; plant breeding; animal husbandry; diseases of animals; poultry culture; dairying; entomology; agricultural engineering.
Missouri (College), Columbia: H. J. Waters	Chemistry; soil survey; botany; agronomy; horticulture; diseases of plants and animals; animal husbandry; plant breeding; dairying; entomology.
Missouri (Fruit), Mountain Grove: Paul Evans	Horticulture; vegetable pathology; entomology; inspection of orchards and nurseries.
Montana, Bozeman: F. B. Linfield	Chemistry; meteorology; botany; agronomy; dry farming; horticulture; animal husbandry; poultry experiments; dairying; entomology; irrigation and drainage.
Nebraska, Lincoln: E. A. Burnett	Chemistry; botany; meteorology; soils; agronomy; horticulture; plant breeding; diseases of plants and animals; forestry; animal husbandry; dairying; entomology; irrigation.
Nevada, Reno: J. E. Stubbs	Chemistry; botany; meteorology; agronomy; horticulture; forestry; plant breeding; plant diseases; animal husbandry; veterinary science and bacteriology; zoology; entomology; irrigation.
New Hampshire, Durham: E. D. Sanderson	Chemistry; botany; agronomy; horticulture; plant breeding; animal husbandry; dairying; entomology.
New Jersey (State), New Brunswick: E. B. Voorhees New Jersey (College), New Brunswick: E. B. Voorhees	Chemistry; oyster culture; botany; analysis of fertilizers, foods, commerical feeding stuffs and insesticides; agronomy; horticulture; plant breeding; diseases of plants and animals; dairy husbandry; entomology; soil chemistry and bacteriology; irrigation.
New Mexico, Agricultural College: Luther Foster	Chemistry; botany; agronomy; dry farming; horticulture; cactus and guayule plant investigations; animal husbandry; dairying; entomology; irrigation.
New York (State), Geneva: W. H. Jordan	Chemistry; bacteriology; meteorology; fertilizers; analysis and control of fertilizers; inspection of creamery glassware, feeding stuffs, and Paris green; agronomy; horticulture; plant breeding; diseases of plants; animal husbandry; poultry experiments; dairying; entomology; irrigation.
New York (Cornell), Ithaca: L. H. Bailey	Chemistry; agronomy; horticulture; plant breeding; diseases of plants; animal husbandry; poultry experiments; dairying; entomology.

Agricultural experiment stations of the United States, their locations, directors, and principal lines of work—Continued.

Station, location, and director.	Principal lines of work.
North Carolina (College), West Raleigh: C. B. Williams	Chemistry; agronomy; nitrification experiments; horticulture; animal husbandry; diseases of animals and plants; poultry experiments; dairying; tests of farm machinery.
North Carolina (State), Raleigh: B. W. Kilgore	Chemistry; agronomy; horticulture; diseases of animals; feeding experiments; entomology; fertilizer experiments and analyses; inspection of foods and stock feeds; cooperative demonstration work with farmers; farmers' institutes.
North Dakota, Agricultural College: J. H. Worst	Chemistry; botany; agronomy; plant breeding; horticulture; forestry; diseases of plants and animals; animal husbandry; poultry experiments; drainage; milling and chemical tests of wheat; inspection and analysis of foods, spraying materials, paints, drugs, proprietary products, and feeding stuffs; farm engineering.
Ohio, Wooster: C. E. Thorne	Chemistry; soils; agronomy; botany; horticulture; plant breeding; forestry; diseases of plants; animal husbandry; entomology; nutrition; farm management.
Oklahoma, Stillwater: John A. Craig	Chemistry; agronomy; horticulture; plant breeding; forestry; botany; bacteriology; diseases of plants and animals; animal husbandry; entomology.
Oregon, Corvallis: J. Withycombe	Chemistry; bacteriology; fertilizers; agronomy; horticulture plant breeding and selection; diseases of plants; animal husbandry; poultry experiments; dairying; entomology; irrigation.
Pennsylvania, State College: T. F. Hunt	Chemistry; meteorology; fertilizers; horticulture; forestry; poultry experiments; plant diseases; agronomy; animal husbandry; dairying.
Pennsylvania (Nutrition Institute), State College: H. P. Armsby	Animal nutrition.
Porto Rico, Mayaguez: D. W. May [a]	Agronomy; plant introductions; plant breeding; horticulture; fruit handling and shipment; chemistry; entomology; plant diseases; animal husbandry; coffee investigations.
Rhode Island, Kingston: H. J. Wheeler	Chemistry; meteorology; soils; analysis and inspection of fertilizers and feeding stuffs; agronomy; horticulture; poultry experiments.
South Carolina, Clemson College: J. N. Harper	Chemistry; analysis and control of fertilizers; botany; agronomy; horticulture; plant breeding; diseases of plants; animal husbandry; dairying; veterinary science; entomology.
South Dakota, Brookings: J. W. Wilson	Chemistry; botany; agronomy; horticulture; plant breeding; diseases of plants and animals; animal husbandry; entomology; dairying.
Tennessee, Knoxville: H. A. Morgan	Chemistry; soil investigations; inspection of fertilizers; agronomy; horticulture; plant breeding; seeds; weeds; diseases of plants and animals; animal husbandry; poultry investigations; apiculture; dairying; entomology.
Texas, College Station: H. H. Harrington	Chemistry; botany and mycology; agronomy; horticulture; plant breeding; animal husbandry; diseases of animals; entomology; irrigation; seed testing; feed inspection.
Utah, Logan: E. D. Ball	Chemistry; agronomy; horticulture; diseases of plants and animals; animal husbandry; dairying; poultry experiments; entomology; irrigation; arid farming.
Vermont, Burlington: J. L. Hills	Chemistry; botany; bacteriology; analysis and control of fertilizers and feeding stuffs; inspection of creamery glassware; agronomy; horticulture; State nursery for forest-tree seedlings; diseases of plants; animal husbandry; dairying.
Virginia (College), Blacksburg: S. W. Fletcher	Chemistry; biology; agronomy; horticulture; plant breeding; bacteriology; mycology; analysis of foods and soils; animal husbandry; veterinary science; dairying; entomology; cider and vinegar making; ferments.
Virginia (Truck), Norfolk: T. C. Johnson [b]	Breeding, diseases, fertilizer requirements, and insect pests of truck crops.

[a] Special agent in charge. [b] Superintendent.

Agricultural experiment stations of the United States, their locations, directors, and principal lines of work—Continued.

Station, location, and director.	Principal lines of work.
Washington, Pullman: R. W. Thatcher	Chemistry; botany; bacteriology; agronomy; horticulture; plant breeding; diseases of plants; animal husbandry; veterinary science; dairying; entomology; irrigation; dry farming.
West Virginia, Morgantown: J. H. Stewart	Chemistry; effect of pressure in the preservation of fruits, vegetables, and milk; artificial fixation of atmospheric nitrogen; analysis and control of fertilizers; inspection of orchards and nurseries; agronomy; horticulture; diseases of plants and animals; animal husbandry; dairying; poultry experiments; entomology.
Wisconsin, Madison: H. L. Russell	Chemistry; bacteriology; agronomy; tobacco and cranberry culture; horticulture; plant breeding; animal husbandry; dairying; irrigation, drainage, and agricultural engineering.
Wyoming, Laramie: J. D. Towar	Chemistry; mycology; botany; meteorology; soils; range improvement; fertilizers; agronomy; plant selection; food analysis; animal husbandry; wool investigations; irrigation.

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

President, M. A. Scovell, director of Kentucky Experiment Station, Lexington, Ky.; secretary-treasurer, J. L. Hills, director of Vermont Experiment Station, Burlington, Vt.

OFFICIALS IN CHARGE OF FARMERS' INSTITUTES.

Farmers' Institute Specialist, Department of Agriculture,

John Hamilton, Washington, District of Columbia.

State superintendents.

State or Territory.	Name of official.	Post-office.
Alabama	C. A. Cary, Alabama Polytechnic Institute	Auburn.
	Thomas M. Campbell, Farmers' Cooperative Demonstration Work.	Tuskegee Institute.
Alaska	C. C. Georgeson, Agricultural Expt. Station	Sitka.
Arizona	R. W. Clothier, Supt. of Farmers' Institutes	Tucson.
Arkansas	C. F. Adams, Agricultural Expt. Station	Fayetteville.
California	W. T. Clarke, Supt. of Farmers' Institutes	Berkeley.
	J. B. Neff, Conductor of Farmers' Institutes	Anaheim.
Colorado	H. M. Cottrell, Director of Farmers' Institutes	Fort Collins
Connecticut	Jas. F. Brown, Secretary Board of Agriculture	N. Stonington.
	J. G. Schwink, jr., Secretary Dairymen's Assn	Meriden.
	H. C. C. Miles, Secretary Pomological Society	Milford.
Delaware	Wesley Webb, Secretary Board of Agriculture	Dover.
Florida	P. H. Rolfs, Director Agricultural Expt. Station	Gainesville.
Georgia	A. M. Soule, President College of Agriculture	Athens.
Hawaii	Wm. Weinrich, jr., Secretary Farmers' Institutes	Box 583, Honolulu.
Idaho	H. T. French, Agricultural Expt. Station	Moscow.
Illinois	Frank H. Hall, Supt. Farmers' Institutes	Aurora.
Indiana	W. C. Latta, Prof. Agriculture, Purdue University	Lafayette.
Iowa	J. C. Simpson, Secretary Board of Agriculture	Des Moines.
Kansas	J. H. Miller, Supt. Farmers' Institutes	Manhattan.
Kentucky	M. C. Rankin, Commissioner of Agriculture	Frankfort.
Louisiana	Charles Schuler, Commissioner of Agriculture	Baton Rouge.
Maine	A. W. Gilman, Commissioner of Agriculture	Augusta.
Maryland	W. L. Amoss, Director of Farmers' Institutes	Benson.
Massachusetts	J. L. Ellsworth, Secretary Board of Agriculture	Boston.
Michigan	L. R. Taft, Supt. of Farmers' Institutes	East Lansing.
Minnesota	A. D. Wilson, Director Farmers' Institutes	St. Anthony Park.
Mississippi	E. R. Lloyd, Director of Farmers' Institutes	Agricultural College.
Missouri	Geo. B. Ellis, Secretary Board of Agriculture	Columbia.
Montana	F. B. Linfield, Agricultural Expt. Station	Bozeman.
	F. S. Cooley, Supt. of Farmers' Institutes	Do.
Nebraska	Val. Keyser, Supt. Farmers' Institutes	Lincoln.
Nevada	J. E. Stubbs, Nevada State University	Reno.

State superintendents—Continued.

State or Territory.	Name of official.	Post-office.
New Hampshire	N. J. Bachelder, Secretary Board of Agriculture	Concord.
New Jersey	Franklin Dye, Secretary Board of Agriculture	Trenton.
New Mexico	J. D. Tinsley, Supt. Farmers' Institutes	Agricultural College.
New York	R. A. Pearson, Commissioner of Agriculture	Albany.
North Carolina	W. A. Graham, Commissioner of Agriculture	Raleigh.
North Dakota	T. A. Hoverstad, Supt. of Farmers' Institutes	Fargo.
Ohio	A. P. Sandles, Secretary State Board of Agriculture.	Columbus.
Oklahoma	T. M. Jeffords, Supt. of Farmers' Institutes	Guthrie.
Oregon	J. Withycombe, Agricultural Expt. Station	Corvallis.
Pennsylvania	A. L. Martin, Deputy Secretary of Agriculture	Harrisburg.
Porto Rico	D. W. May, Agricultural Experiment Station	Mayaguez.
Rhode Island	John J. Dunn, Secretary Board of Agriculture	Providence.
South Carolina	D. N. Barrow, Professor of Agriculture	Clemson College.
South Dakota	A. E. Chamberlain, Supt. of Farmers' Institutes	Brookings.
Tennessee	John Thompson, Commissioner of Agriculture	Nashville.
Texas	Ed. R. Kone, Commissioner of Agriculture	Austin.
Utah	Lewis A. Merrill, Superintendent of Farmers' Institutes.	312 Security and Trust Building, Salt Lake City.
Vermont	O. L. Martin, Commissioner of Agriculture	Plainfield.
Virginia	G. W. Koiner, Commissioner of Agriculture	Richmond.
Washington	R. W. Thatcher, Acting Supt. Farm. Institutes	Pullman.
	O. M. Olson, Deputy Supt. Farm. Institutes	Do.
West Virginia	J. B. Garvin, Secretary State Board of Agriculture	Charleston.
Wisconsin	G. B. McKerrow, Director Farmers' Institutes	Madison.
Wyoming	J. D. Towar, Director Agricultural Expt. Station	Laramie.

AMERICAN ASSOCIATION OF FARMERS' INSTITUTE WORKERS.

President, J. L. Ellsworth, Secretary State Board of Agriculture, Boston, Mass.; secretary-treasurer, John Hamilton, Farmers' Institute Specialist, U. S. Department of Agriculture, Washington, D. C.

STATISTICS OF FARMERS' INSTITUTES.

Farmers' institutes were held during the year ended June 30, 1908, in all of the States and Territories excepting Alaska, Louisiana, Nevada, Oklahoma, and Porto Rico. The following table gives a summary of the work of the year:

Statistics of farmers' institutes for season ended June 30, 1908.

State or Territory.	Total.	Meetings.			Speakers on State force.	Funds appropriated for institutes.		Report of proceedings.	
		One day.	Two days or more.	Total attendance.		Year ended June 30, 1908.	Year ended June 30, 1909.	Published.	Copies.
Alabama	40	40		8,844	14	$1,000.00	$1,000.00		
Arizona	56	56		2,673	3	1,745.00	(a)		
Arkansas	56	50	6	5,596	6	1,500.00	1,500.00	Yes	12,500
California	88	49	39	27,912	36	8,000.00	6,000.00		
Colorado	126	118	8	38,930	21	7,724.46	5,000.00		
Connecticut	25	24	1	3,700	54	1,700.00	1,500.00		
Delaware	19	14	5	4,905	9	725.00	600.00	Yes	5,000
Florida	26	23	3	3,316	14	2,500.00	3,000.00		
Georgia	40	38	2	12,000	14	4,000.00	4,000.00		
Hawaii	4	4		150	(a)	74.49	(a)		
Idaho	12	2	10	5,650	10	1,000.00	1,000.00		
Illinois	108		108	122,523	91	29,540.00	7,650.00	Yes	20,000
Indiana	321	161	160	195,912	49	18,000.00	10,000.00	Yes	1,000
Iowa	75		75	75,000	16	7,954.98	6,000.00		
Kansas	176	111	65	33,684	34	6,495.51	6,000.00		
Kentucky	132	4	128	21,690	22	8,982.85	13,000.00	Yes	25,000
Maine	50	50		14,143	25	3,000.00	3,000.00	Yes	6,000
Maryland	41	21	20	8,903	9	6,000.00	6,000.00		
Massachusetts	127	127		18,412	58	4,000.00	4,000.00		
Michigan	326	248	78	121,654	47	8,500.00	(a)	Yes	10,000
Minnesota	272	267	5	92,091	16	20,454.50	18,000.00	Yes	35,000

a No report.

Statistics of farmers' institutes for season ended June 30, 1908—Continued.

State or Territory.	Total.	Meetings.			Speakers on State force.	Funds appropriated for institutes.		Report of proceedings.	
		One day.	Two days or more.	Total attendance.		Year ended June 30, 1908.	Year ended June 30, 1909.	Published.	Copies.
Mississippi	129	124	5	28,910	23	$5,000.00	$5,000.00	Yes	10,000
Missouri	250	150	100	40,000	23	5,000.00	(a)		
Montana	72	66	6	12,293	22	7,500.00	7,500.00	Yes	6,000
Nebraska	175	61	114	93,824	44	13,617.68	10,000.00	Yes	2,000
New Hampshire	16	16		2,500	16	1,000.00	(a)	Yes	1,500
New Jersey	37	30	7	10,154	12	2,500.00	8,000.00	Yes	6,000
New Mexico	50	47	3	3,685	11	1,425.00	800.00		
New York	307	142	165	149,418	61	25,000.00	25,000.00	Yes	5,000
North Carolina	194	194		52,978	33	7,500.00	(a)	Yes	30,000
North Dakota	90	81	9	38,000	7	6,721.65	6,000.00	Yes	10,000
Ohio	298		298	461,515	51	23,986.15	22,000.00	Yes	20,000
Oregon	32	30	2	7,500	6	2,500.00	2,500.00		
Pennsylvania	217	36	181	145,353	73	23,000.00	23,000.00	Yes	8,000
Rhode Island	15	15		1,800	16	125.00	(a)		2,500
South Carolina	40	39	1	13,392	10	2,000.00	750.00		
South Dakota	86	29	57	43,560	8	7,000.00	7,000.00		
Tennessee	84	81	3	18,915	17	5,000.00	5,000.00	Yes	1,350
Texas	36	36		(a)	10	382.25	(a)		
Utah	25	4	21	26,926	18	3,485.32	2,500.00	Yes	10,000
Vermont	28	28		5,160	13	5,000.00	(a)	Yes	4,000
Virginia[a]									
Washington	78	57	21	15,346	18	5,000.00	5,000.00	Yes	1,000
West Virginia	112	12	100	16,748	27	5,644.41			
Wisconsin	141	47	94	89,244	24	20,000.00	20,000.00	Yes	60,000
Wyoming	11	5	6	3,359	13	1,000.00	1,000.00	Yes	6,000
Total	4,643	2,737	1,906	2,098,268	1,104	322,284.25	248,300.00		297,850

[a] No report.

STATE OFFICIALS IN CHARGE OF AGRICULTURE.[a]

Commissioners of Agriculture.[b]

State or Territory.	Name of official.	Post-office.
Alabama	J. A. Wilkinson	Montgomery.
Arkansas	Guy B. Tucker	Little Rock.
Florida	B. E. McLin	Tallahassee.
Georgia	T. G. Hudson	Atlanta.
Idaho	Joseph P. Fallon, commissioner of immigration, etc	Boise.
Kentucky	M. C. Rankin	Frankfort.
Louisiana	Charles Schuler	Baton Rouge.
Maine	A. W. Gilman	Augusta.
Maryland	W. Frank Hines	Baltimore.
Mississippi	H. E. Blakeslee	Jackson.
Montana	Jno. H. Hall	Helena.
New Mexico	Nathan Jaffa, secretary of state	Santa Fe.
New York	Raymond A. Pearson	Albany.
North Carolina	W. A. Graham	Raleigh.
North Dakota	W. C. Gilbreath	Bismarck.
Pennsylvania	N. B. Critchfield, secretary of agriculture	Harrisburg.
Philippine Islands	G. E. Nesom, director of agriculture	Manila.
Porto Rico	Laurance H. Grahame, commissioner of the interior	San Juan.
South Carolina	E. J. Watson	Columbia.
Tennessee	John Thompson	Nashville.
Texas	Ed. R. Kone	Austin.
Vermont	O. L. Martin	Plainfield.
Virginia	Geo. W. Koiner	Richmond.
Washington	Sam H. Nichols, secretary of state	Olympia.

[a] Officials of Territories and island dependencies are included. So far as learned, Arizona, New Mexico and Utah have no state official charged with agricultural interests, but letters addressed to the secretary of state will receive attention.
[b] Some of these officials have not the title of commissioner, but those given with their names.

Secretaries of State Boards of Agriculture.

State or Territory.	Name of official.	Post-office.
California	J. A. Filcher	Sacramento.
Colorado	A. M. Hawley	Fort Collins.
Connecticut	J. F. Brown	North Stonington.
Delaware	Wesley Webb	Dover.
Hawaii	Marston Campbell	Honolulu.
Illinois	J. K. Dickirson	Springfield.
Indiana	Chas. Downing	Indianapolis.
Iowa	J. C. Simpson	Des Moines.
Kansas	F. D. Coburn	Topeka.
Kentucky	Perry M. Shy	Frankfort.
Louisiana	Eugene Jastremski	Baton Rouge.
Maryland	A. F. Trappe	Baltimore.
Massachusetts	J. L. Ellsworth	Boston.
Michigan	Addison M. Brown	East Lansing.
Minnesota	C. N. Cosgrove, secretary state agricultural society	St. Paul.
Missouri	George B. Ellis	Columbia.
Nebraska	W. R. Mellor	Lincoln.
Nevada	Louis Bevier	Carson City.
New Hampshire	N. J. Bachelder	Concord.
New Jersey	Franklin Dye	Trenton.
North Carolina	Elias Carr, Secretary	Raleigh.
Ohio	A. P. Sandles	Columbus.
Oklahoma	Chas. F. Barrett	Guthrie.
Oregon	F. A. Welch	Salem.
Rhode Island	John J. Dunn	Providence.
South Dakota	C. N. McIlvaine	Huron.
West Virginia	J. B. Garvin	Charleston.
Wisconsin	John M. True	Madison.
Wyoming	C. T. Johnston, state engineer	Cheyenne.

DAIRY ASSOCIATIONS, INTERNATIONAL AND NATIONAL.

Name of organization.	Secretary.	Post-office.
International Milk Dealers' Association.	B. D. White	Dept. of Agriculture, Washington.
Association of State and National Food and Dairy Departments.	R. M. Allen	Lexington, Ky.
Association of Inspectors and Instructors of the National and State Dairy and Food Departments.	B. D. White	Dept. of Agriculture, Washington.
Official Dairy Instructors' Association	C. B. Lane	Do.
National Dairy Union	Chas. Y. Knight	154 Lake street, Chicago, Ill.
National Dairy Show Association	E. Sudendorf	154 Washington street, Chicago, Ill.
National Creamery Buttermakers' Association.	S. B. Shilling	154 Lake street, Chicago, Ill.
American Association of Medical Milk Commissions.	Otto P. Geier	124 Garfield place, Cincinnati, Ohio.
Certified Milk Producers' Association of America.	R. A. Pearson	Capitol, Albany, N. Y.

AMERICAN NATIONAL LIVE STOCK ASSOCIATION.

President, H. A. Jastro, Bakersfield, Cal.; secretary, T. W. Tomlinson, Denver, Colo.

AMERICAN ASSOCIATION OF LIVE STOCK HERDBOOK SECRETARIES.

President, C. R. Thomas, Kansas City, Mo.; secretary, Charles F. Mills, Springfield, Ill.

NATIONAL WOOL GROWERS' ASSOCIATION.

President, Fred W. Gooding, Shoshone, Idaho; secretary, George S. Walker, Cheyenne, Wyo.

THE CORN-BELT MEAT PRODUCERS' ASSOCIATION.

President, A. Sykes, Buckingham, Iowa; secretary, H. C. Wallace, Des Moines, Iowa.

PROTECTION AGAINST CONTAGION FROM FOREIGN CATTLE.

An act of Congress of August 28, 1894, prohibits the importation of cattle and cattle hides, but by the act of March 2, 1895, making appropriations for the Department of Agriculture, it is provided that the prohibition may be suspended by the President whenever the Secretary of Agriculture shall certify to the President what countries or parts of countries are free from contagious or infectious diseases of domestic animals. The President, by proclamation of November 8, 1895, lifted the embargo with reference to Norway, Sweden, Holland, Great Britain, Ireland, the Channel Islands, and the countries of North, Central, and South America so as to admit cattle under sanitary regulations prescribed by the Secretary of Agriculture; also, from all countries so as to admit hides under regulations prescribed by the Secretary of the Treasury.

STOCK BREEDERS' ASSOCIATIONS.[a]

Names and addresses of stock breeders' association secretaries, with breeds and numbers of registered live stock in the United States June 30, 1908.

CATTLE.

Breed.	Secretary.	Post-office.	Number registered. Male.	Female.	Total.
Aberdeen Angus	Chas. Gray	Union Stock Yards, Chicago, Ill.	40,836	65,526	106,362
Ayrshire	C. M. Winslow	Brandon, Vt.	10,864	23,175	34,039
Devon	L. P. Sisson	Newark, Ohio	8,419	14,335	22,754
Dutch Belted	H. P. Richards	Easton, Pa.	685	1,488	2,173
Galloway	R. W. Brown	Union Stock Yards, Chicago, Ill.	14,191	19,030	32,221
Guernsey	Wm. H. Caldwell	Peterboro, N. H.	13,371	24,782	38,153
Hereford	C. R. Thomas	225 W. 12th street, Kansas City, Mo.	([b])	([b])	296,391
Holstein Friesian	F. L. Houghton	Brattleboro, Vt.	56,555	115,696	172,251
Jersey	J. J. Hemingway	8 W. 17th street, New York City.	80,719	217,146	297,865
Polled Durham	J. H. Martz	Greenville, Ohio	7,335	9,173	16,508
Shorthorn	J. W. Groves	Union Stock Yards, Chicago, Ill.	299,000	457,903	756,903
Sussex	Overton Lea	Nashville, Tenn.	88	196	284
Swiss (Brown)	C. D. Nixon	Owego, N. Y.	2,654	3,842	6,496
Red Polled	H. A. Martin	Gotham, Wis.	17,678	28,648	46,326

[a] Under the provisions of paragraph 473 of the act of July 24, 1897, amended March 3, 1903, any animal imported specially for breeding purposes by a citizen of the United States shall be admitted free, provided that no such animal shall be admitted free unless pure bred, of a recognized breed, and duly registered in the book of record established for that breed. The Secretary of the Treasury, upon the advice of the Secretary of Agriculture, issued, July 11, 1906, regulations for the importation of animals under this law and designated the recognized breeds and the books of record established for these breeds.

[b] No data.

HORSES.

Cleveland Bay	R. P. Stericker	80 Chestnut avenue, West Orange, N. J.	1,270	527	1,797
Clydesdale	R. B. Ogilvie	Union Stock Yards, Chicago, Ill.	([a])	([a])	13,783
Coach, French (Register).	Chas. C. Glenn	Columbus, Ohio	284	11	295
Coach, French (Society)	Duncan E. Willet	Maple avenue and Harrison st., Oak Park, Ill.	2,254	741	2,995
Coach, German	J. Crouch	Lafayette, Ind.	2,341	325	2,666
Draft, Belgian	J. D. Conner, jr.	Wabash, Ind.	3,261	643	3,904
Draft, French	C. E. Stubbs	Fairfield, Iowa	10,630	6,476	17,106
Hackney	Gurney C. Gue	308 W. 97th st., New York, N. Y.	1,099	2,001	3,100
Morgan	T. E. Boyce	Middlebury, Vt.	5,521	1,790	7,311
Percheron (Society)	Geo. W. Stubblefield	Union Stock Yards, Chicago, Ill.	6,693	6,873	13,566
Percheron (Register)	Chas. C. Glenn	Columbus, Ohio	1,177	625	1,802
Percheron (Company)	John A. Forney	Plainfield, Ohio	1,498	1,103	1,601
Saddle Horse	I. B. Nall	Louisville, Ky.	3,303	4,925	8,228
Shetland Pony	Mortimer Levering	Lafayette, Ind.	2,933	4,448	7,381
Shire	Chas. Burgess	Wenona, Ill.	7,105	2,724	9,829
Suffolk	Alex. Galbraith	Janesville, Wis.	206	148	354
Thoroughbred	W. H. Rowe	571 Fifth avenue, New York, N. Y.	([a])	([a])	53,712

[a] No data.

Names and addresses of stock breeders' association secretaries, with breeds and numbers of registered live stock in United States June 30, 1908—Continued.

HORSES—Continued.

Breed.	Secretary.	Post-office.	Number registered.		
			Male.	Female.	Total.
Trotter American	W. H. Knight	355 Dearborn street, Chicago, Ill.	48,822	164,283	213,105
Welsh Pony	John Alexander	Aurora, Ill	13	20	33
Jacks and jennets	J. W. Jones	Columbia, Tenn	1,758	1,042	2,790

SHEEP.

Cheviot	F. E. Dawley	Fayetteville, N. Y	(a)	(a)	11,845
Cotswold	F. W. Harding	Waukesha, Wis	(a)	(a)	42,990
Dorset Horn	J. E. Wing	Mechanicsburg, Ohio	2,175	5,492	7,667
Hampshire Down	Comfort A. Tyler	Coldwater, Mich	7,478	16,813	24,291
Leicester	A. J. Temple	Cameron, Ill	4,688	6,979	11,667
Lincoln	Bert Smith	Charlotte, Mich	7,426	10,566	17,992
Merino (Delaine)	Beulah M. McDowell	Canton, Ohio	(a)	(a)	10,975
Merino (Delaine)	J. B. Johnson	248 W. Pike street, Canonsburg, Pa.	7,126	12,153	19,279
Merino (French)	Dwight Lincoln	Milford Center, Ohio	(a)	(a)	47,693
Merino (German)	E. N. Ball	Ann Arbor, Mich	212	291	503
Merino (Spanish)	do	do	12,595	37,845	50,440
Merino (Spanish)	Wesley Bishop	R. F. D. 1, Delaware, Ohio.			[b]293,123
Oxford Down	W. A. Shafor	Hamilton, Ohio	(a)	(a)	42,727
Shropshire	Mortimer Levering	Lafayette, Ind	123,000	171,000	294,000
Southdown	Frank S. Springer	Springfield, Ill	(a)	(a)	23,057

[a] No data. [b] Total of animals registered in the Vermont, New York, and Ohio Merino registers.

HOGS.

Berkshire	Frank S. Springer	Springfield, Ill	(a)	(a)	112,080
Cheshire	Ed. S. Hill	Freeville, N. Y	1,329	2,794	4,123
Chester Ohio Improved.	J. C. Hiles	Cleveland, Ohio	(a)	(a)	21,353
Duroc Jersey (American).	T. B. Pearson	Thorntown, Ind	11,306	27,408	38,714
Duroc Jersey (National)	H. C. Sheldon	Peoria, Ill	39,050	96,500	135,550
Hampshire (Thin Rind).	E. C. Stone	Armstrong, Ill	1,078	2,484	3,562
Poland China (American).	W. M. McFadden	Union Stock Yards, Chicago, Ill.	69,969	172,405	242,374
Poland China (National).	A. M. Brown	Drawer 16, Winchester, Ind.	36,500	81,000	117,500
Poland China (Standard).	Geo. F. Woodworth	Maryville, Mo	49,978	120,292	170,270
Poland China (Southwestern).	H. P. Wilson	Gadsden, Tenn	1,122	1,650	2,772
Tamworth	E. N. Ball	Ann Arbor, Mich	(a)	(a)	4,753
Yorkshire	Harry G. Krum	White Bear Lake, Minn.	(a)	(a)	7,922

[a] No data.

SANITARY OFFICERS IN CHARGE OF LIVE STOCK INTERESTS.

State or Territory.	Name and post-office.	Official position.
Alabama	C. A. Cary, Auburn	State veterinarian.
Arizona	J. D. Carter, Prescott	Secretary live-stock sanitary board.
	J. C. Norton, Phoenix	Veterinarian.
Arkansas	J. W. Lenzy, Fayetteville	State veterinarian.
California	Chas. Keane, Sacramento	Do.
Colorado	Chas. G. Lamb, Denver	State veterinary surgeon.
	L. B. Sylvester, Monte Vista	President State board of stock inspection commissioners.
Connecticut	H. O. Averill, Hartford	Commissioner on domestic animals.
Delaware	C. F. Dawson, Newark	Veterinarian, Delaware Agricultural Experiment Station, Delaware College.

Sanitary officers in charge of live stock interests—Continued.

State or Territory.	Name and post-office.	Official position.
Florida	T. J. Mahaffy, Jacksonville	Veterinarian, State board of health.
Georgia	T. G. Hudson, Atlanta	Commissioner of agriculture.
Hawaii	V. A. Nörgaard, Honolulu	Territorial veterinarian.
Idaho	G. E. Noble, Boise	State veterinarian.
Illinois	J. M. Wright, 1827 Wabash avenue, Chicago.	Do.
	W. E. Savage, Springfield	Secretary State board of live-stock commissioners.
Indiana	W. E. Coover, Indianapolis	State veterinarian.
Iowa	P. O. Koto, Des Moines	Do.
Kansas	J. H. Mercer. Topeka	Live stock sanitary commissioner.
	F. S. Schoenleber, Manhattan	Veterinarian, experiment station.
Kentucky	F. T. Eisenman, Louisville	State veterinarian.
Louisiana	E. P. Flower, Baton Rouge	Secretary and executive officer State live stock sanitary board.
Maine	F. O. Beal, Bangor	Board of cattle commissioners.
	J. M. Deering, Saco	
	F. S. Adams, Bowdoin	
Maryland	F. H. Mackie, 912 Cathedral street, Baltimore.	Chief veterinary inspector..
	Wade H. D. Warfield, Baltimore	Secretary live-stock sanitary board.
Massachusetts	Austin Peters, State House, Boston	Chief of cattle bureau, State board of agriculture.
Michigan	H. H. Hinds, Stanton	President State live-stock sanitary commission.
	C. A. Tyler, Coldwater	Secretary State live-stock sanitary commission.
	W. M. Morris, Cass City	State veterinarian.
Minnesota	Chas. A. Nelson, Anoka	President State live-stock sanitary board.
	S. H. Ward, St. Paul	Secretary and executive officer State live-stock sanitary board.
Mississippi	James Lewis, Agricultural College	State veterinarian.
Missouri	D. F. Luckey, Columbia	Do.
	Geo. B. Ellis, Columbia	Secretary State board of agriculture.
Montana	M. E. Knowles, Helena	State veterinarian.
	W. G. Preuitt, Helena	Secretary live-stock commission.
Nebraska	A. C. Shallenberger, Lincoln	State veterinarian.
Nevada	I. W. O'Rourke, Reno	Do.
New Hampshire	N. J. Bachelder, Concord	Secretary board of cattle commissioners.
New Jersey	Franklin Dye, Trenton	Secretary commission on tuberculosis in animals.
	E. B. Voorhees, New Brunswick	President State board of agriculture.
New Mexico	E. G. Austen, Las Vegas	Secretary cattle sanitary board.
	H. F. Lee, Albuquerque	Secretary sheep sanitary board.
New York	R. A. Pearson, Albany	Commissioner of agriculture.
	W. H. Kelly, Albany	Chief of bureau of veterinary service.
North Carolina	W. G. Chrisman, Raleigh	State veterinarian.
	W. A. Graham, Raleigh	Commissioner of agriculture.
North Dakota	W. F. Crewe, Devils Lake	State veterinarian.
Ohio	Paul Fischer, Columbus	Do.
	A. P. Sandles, Columbus	Secretary State live-stock commission.
Oklahoma	J. K. Callicotte, Guthrie	State veterinarian.
	G. T. Bryan, Guthrie	Superintendent live-stock inspection.
Oregon	W. H. Lytle, Pendleton	State veterinarian and sheep inspector.
Pennsylvania	Leonard Pearson, Harrisburg	State veterinarian.
Porto Rico	T. A. Allen, San Juan	Veterinary inspector, health office.
Rhode Island	John S. Pollard, Providence	Veterinarian State board of agriculture.
	J. J. Dunn, Providence	Secretary State board of agriculture.
South Carolina	M. Ray Powers, Clemson College	State veterinarian.
South Dakota	T. H. Hicks, Milbank	Do.
	C. L. Eakin, Blunt	Secretary State live-stock commission.
Tennessee	W. H. Dunn, Gallatin	State live-stock commissioner.
	John Thompson, Nashville	Commissioner of agriculture.
Texas	R. H. Harris, San Angelo	Chairman live-stock sanitary commission.
Utah	T. B. Beatty, Salt Lake City	Secretary State board of health.
	L. K. Anderson, Manti	President State board of sheep commissioners.
Vermont	H. S. Willson, Arlington	Cattle commissioner.
Virginia	J. G. Ferneyhough, Burkeville	State veterinarian.
Washington	S. B. Nelson, Pullman	State veterinarian.
West Virginia	J. B. Garvin, Charleston	Secretary board of agriculture.
Wisconsin	J. M. True, Madison	Secretary State live-stock sanitary board.
	D. B. Clark, Madison	State veterinarian.
Wyoming	W. F. Pflaeging, Cheyenne	Do.
	Thomas Durbin, Cheyenne	Secretary State board of live-stock commissioners.
	Geo. S. Walker, Cheyenne	Secretary State board sheep commissioners.

FORESTRY ASSOCIATIONS.

American Forestry Association.—President, Hon. Curtis Guild, jr., Boston, Mass.; treasurer and secretary, Otto Luebkert, Washington, D. C.

The Appalachian National Forest Association.—President, D. A. Tompkins, Charlotte, N. C.; secretary and treasurer, John H. Finney, Washington, D. C.

International Society of Arboriculture.—President, Gen. William J. Palmer, Colorado Springs, Colo.; vice-president, Henry John Elwes, F. R. S., Colesborne, Cheltenham, England; secretary, J. P. Brown, Connersville, Ind.

Society of American Foresters.—President, Gifford Pinchot, Washington, D. C.; secretary, W. F. Sherfesee, Washington, D. C.

State organizations.

Name of organization.	Secretary.	Address.
Appalachian Mountain Club	R. B. Lawrence	Tremont Building, Boston.
Arizona: Salt River Valley Water Users' Association.	Chas. A. Van der Veer.	Phoenix.
California:		
Water and Forest Association	T. C. Friedlander	1405 The Merchants' Exchange Building, San Francisco.
Forestry Educational Association	E. C. Damon	San Diego.
Sierra Club	William E. Colby	San Francisco.
Pacific Coast Forest, Fish, and Game Association.	Wm. Greer Harrison	Do.
Tri-Counties Reforestation Committee	L. A. Finch	Riverside.
Cincinnati Forest and Improvement Association	Adolph Leue	127 West Twelfth street.
Colorado Forestry Association	Ellsworth Bethel	Denver.
Connecticut Forestry Association	F. H. Stadtmüller	Elmwood.
Georgia Forestry Association	Alfred Akerman	Athens.
Iowa Park and Forestry Association	Wesley Greene	Des Moines.
Maine Forestry Association	E. E. Ring	Augusta.
Massachusetts Forestry Association	Edwin A. Start	4 Joy street, Boston.
Michigan Forestry Association	H. G. Stevens	25 Band Chambers, Detroit.
Minnesota State Forest Association	E. G. Cheyney	St. Anthony Park.
Nebraska Park and Forestry Association	Miss Leila B. Craig	York.
New England Forest, Fish, and Game Association.	Arthur T. Harris	84 State street, Boston, Mass.
New Hampshire: Society for the Protection of New Hampshire Forests.	Allen Hollis	Concord.
New York:		
State Fish, Game, and Forest League	John D. Whish	Capitol, Albany.
Forestry, Water Storage, and Manufacturing Association of the State of New York.	John C. Durgin	1 Broadway, New York.
Association for the Protection of the Adirondacks.	E. H. Hall	Tribune Building, New York.
Northern New York Forestry Association	O. B. Tappan, director	Potsdam.
American Forest Preservation Society	George Milroy Bailey	Corfu.
North Dakota State Sylvaton Society	Miss Ella J. Mitchell	Penn.
Ohio State Forestry Society	C. W. Waid	New Carlisle.
Oregon Forestry Association	Arthur D. Monteith	785 Irving street, Portland.
Pennsylvania:		
Forestry Association	F. L. Bitler	1012 Walnut street, Philadelphia.
Franklin Forestry Society	W. G. Bowers	Chambersburg.
Vermont Forestry Association	Ernest Hitchcock	Pittsford.
Washington Conservation Association	Clarence H. Bailey	P. O. box 236, Seattle.
West Virginia Forestry Association	A. W. Nolan	Morgantown.

SCHOOLS OF FORESTRY.

Post-Graduate Schools.

Yale University, Forest School, New Haven, Conn.—A two years' post-graduate course, leading to the degree of Master of Forestry. Under the direction of the officers of the Yale Forest School a two months' summer course, July and August, is conducted at Milford, Pike County, Pa. Prof. Henry S. Graves, Director.

University of Michigan, Forest School (part of the general Department of Literature, Science, and the Arts), Ann Arbor, Mich.—A two years' post-graduate course, leading to the degree of Master of Science in Forestry. A six weeks' summer course, in July and August, is conducted on the State reserve at Roscommon. Prof. Filibert Roth, Professor of Forestry.

Harvard University, Forest School, Cambridge, Mass.—A two years' graduate course, in connection with the Graduate School of Applied Science. Prof. R. T. Fisher in charge of curriculum.

Undergraduate Schools.

Biltmore Forest School, Biltmore, N. C.—Course covers one full year, leading to the degree of Bachelor of Forestry, and, with two years of practical forest work, the degree of Forest Engineer. Dr. C. A. Schenck, Director.

University of Minnesota, School of Forestry, St. Anthony Park, Minn.—A four years' undergraduate course, leading to the degree of Bachelor of Science in Forestry. A six weeks' summer course, in July and August, is conducted at the Itasca State Forest. Prof. Samuel B. Green, Professor of Forestry.

University of Nebraska, Department of Forestry, Lincoln, Nebr.—A four years' undergraduate course, leading to the degree of Bachelor of Science. Frank J. Phillips, Professor of Forestry.

Michigan State Agricultural College, Department of Forestry, East Lansing, Mich.—A four years' undergraduate course, leading to the degree of Bachelor of Science. J. Fred Baker, Professor of Forestry.

Pennsylvania State College, Forest School, State College, Pa.—A four years' undergraduate course, in connection with the State Department of Agriculture, leading to the degree of Bachelor of Science. Hugh P. Baker, Professor of Forestry.

University of Washington, School of Forestry, Seattle, Wash.—A four years' undergraduate course leading to the degree of Bachelor of Science in Forestry. Frank J. Miller, Professor of Forestry.

University of Georgia, Department of Forestry, Athens, Ga.—A four years' undergraduate course, leading to the degree of Bachelor of Science in Forestry. Alfred Akerman, Professor of Forestry.

Colorado School of Forestry, Colorado Springs, Colo.—A three years' undergraduate course, leading to the degree of Bachelor of Forestry. No entrance requirements. A summer course is conducted at Manitou Park from July 15 to September 15.

The Mont Alto Forest Academy, Mont Alto, Pa.—Maintained by the Pennsylvania Department of Forestry for the training of young men of the State for work on the State forest reserves. Geo. H. Wirt in charge of forest courses.

Courses in forestry are now given at the University of Maine, Orono, Me., Gordon E. Tower, in charge; Iowa State College, Ames, Iowa, Chas. A. Scott, in charge; Mississippi Agricultural and Mechanical College, Agricultural College, Miss., Geo. L. Clothier, in charge; Purdue University, Lafayette, Ind., Prof. John M. Coulter, in charge; the University of West Virginia, Morgantown, W. Va., Prof. A. W. Nolan, in charge; Berea College, Berea, Ky., W. L. Flanery, in charge; State College of Washington, Pullman, Wash., C. H. Goetz, in charge; Winona College of Agriculture, Winona Lake, Ind., W. R. Eastman, in charge; North Dakota School of Forestry, Bottineau, N. Dak., J. Allen Kemp, president.

A course of lectures is given annually at the Massachusetts State Agricultural College, Amherst, by Prof. Frank Wm. Rane, State Forester of Massachusetts; at the Maryland Agricultural College, College Park, by Fred W. Besley, State Forester of Maryland; at the University of Wisconsin, Madison, by Edward M. Griffith, State Forester of Wisconsin; at the Agricultural College of Utah, Logan, by W. W. Clark; at the Connecticut Agricultural College, Storrs; and at the State Agricultural College of Colorado, Fort Collins.

STATE FOREST OFFICERS.

State or Territory.	Name and post-office.	Official position.
Alabama	John H. Wallace, jr., Montgomery	Commissioner, department of game and fish.
California	Gerard B. Lull, Sacramento	State forester.
Connecticut	Walter Owen Filley, New Haven	Do.
Hawaii	Ralph S. Hosmer, Honolulu	Superintendent of forestry.
Indiana	W. H. Freeman, Indianapolis	Secretary State board of forestry.
Kansas	Henry Cooper, Dodge City	Commissioner of forestry.
	F. H. Ridgway, Ogallah	Do.
Kentucky	M. C. Rankin, Frankfort	Chairman State board of agriculture, forestry, and immigration.
Louisiana	A. W. Crandell, Baton Rouge	State forest commissioner.
Maine	Edgar E. Ring, Augusta	Land agent and forest commissioner.
Massachusetts	F. Wm. Rane, Boston	State forester.
Maryland	F. W. Besley, Baltimore	Do.
Michigan	Huntley Russell, Lansing	Secretary forestry commission.
	Filibert Roth, Ann Arbor	State forest warden.
Minnesota	Gen. C. C. Andrews, St. Paul	Secretary State forestry board and forestry commissioner.
New Hampshire	R. E. Faulkner, Keene	Secretary forest commission.
New Jersey	Alfred Gaskill, Trenton	Secretary forest park reservation commission, and forester.

State forest officers—Continued.

State or Territory.	Name and post-office.	Official position.
New York	James S. Whipple, Albany	Commissioner forest, fish, and game commission.
	Wm. F. Fox, Albany	Superintendent of State forests.
	C. R. Pettis	State forester.
North Carolina	Joseph H. Pratt, Chapel Hill	State geologist.
Ohio	Wm. G. Green, Wooster	Forester, State agricultural experiment station.
Oregon	J. W. Baker, Cottage Grove	Forestry, fish, and game warden.
	E. P. Sheldon, Portland	Secretary forestry commission.
Pennsylvania	Robert S. Conklin, Harrisburg	Commissioner of forestry.
	George H. Wirt, Mont Alto	Chief forester.
Rhode Island	Jesse B. Mowry, Chepatchet	Commissioner of forestry.
Vermont	Austin F. Hawes, Randolph	State forester.
Washington	R. W. Condon, Port Gamble	Chairman State board of forest commissioners.
	J. R. Welty, Olympia	State fire warden and forester.
West Virginia	I. C. White, Morgantown	State geologist.
Wisconsin	Edward M. Griffith, Madison	State forester.

NATIONAL BEE KEEPERS' ASSOCIATION.

President, Geo. E. Hilton, Fremont, Mich.; secretary, E. M. Hunt, Lansing, Mich.; general manager and treasurer, N. E. France, Platteville, Wis.

ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

President, W. E. Britton, New Haven, Conn.; secretary, A. F. Burgess, Bureau of Entomology, U. S. Department of Agriculture, Washington, D. C.

ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS.

President, W. D. Bigelow, Department of Agriculture, Washington, D. C.; secreary, H. W. Wiley, chemist, Department of Agriculture, Washington, D. C.

HORTICULTURAL AND KINDRED SOCIETIES.

Name of organization.	Secretary.	Post-office.
American Apple Growers' Congress	T. C. Wilson	5633 Clemens avenue, St. Louis, Mo.
American Association of Nurserymen	Geo. C. Seager	Rochester, N. Y.
American Carnation Society	A. F. J. Baur	Indianapolis, Ind.
American Cranberry Growers' Association	A. J. Rider	Hammonton, N. J.
American Federation of Horticultural Societies	Chas. E. Bassett	Fennville, Mich.
American Institute	Robt. A. B. Dayton	15 William street, New York, N. Y.
American Pomological Society	John Craig	Ithaca, N. Y.
American Retail Nurserymen's Protective Association.	Guy A. Bryant	Princeton, Ill.
American Rose Society	Benj. Hammond	Fishkill on the Hudson, N.Y.
Chrysanthemum Society of America	C. W. Johnson	Rockford, Ill.
Cider and Cider Vinegar Makers' Association of the Northwest.	Geo. Miltenberger	213 North Second street, St. Louis, Mo.
Eastern Nurserymen's Association	Wm. Pitkin	Rochester, N. Y.
International Apple Shippers' Association	C. P. Rothwell	Martinsburg, W. Va.
Mississippi Valley Apple Growers' Association	James Handly	Quincy, Ill.
Missouri Valley Horticultural Society	A. V. Wilson	Muncie, Kans.
National Association of Retail Nurserymen	Fred. E. Grover	Rochester, N. Y.
National Council of Horticulture	H. C. Irish	Missouri Botanical Garden, St. Louis, Mo.
National League of Commission Merchants of the United States.	P. M. Kiely	903 North Fourth street, St. Louis, Mo.
National Nut Growers' Association	J. F. Wilson	Poulan, Ga.
Northwestern Fruit Growers' Association	E. R. Lake	Corvallis, Oreg.
Pacific Coast Association of Nurserymen	C. A. Tonneson	Tacoma, Wash.
Peninsula Horticultural Society	Wesley Webb	Dover, Del.
Society for Horticultural Science	C. P. Close	College Park, Md.
Society of American Florists and Ornamental Horticulturists.	W. N. Rudd	Morgan Park, Ill.
Southern Nurserymen's Association	A. I. Smith	Knoxville, Tenn.
Southwestern Nurserymen's Association	J. A. Taylor	Wynnewood, Okla.
Western Association of Nurserymen	E. J. Holman	Leavenworth, Kans.
Western Fruit Jobbers' Association	E. B. Branch	Omaha, Nebr.

STATE HIGHWAY OFFICIALS.

State.	Name and title.	Post-office.
Arizona	J. B. Girond, Territorial engineer	Phoenix.
California	N. Ellery, State engineer, department of engineering.	Sacramento.
Connecticut	James H. MacDonald, commissioner, State highway department.	Hartford.
Colorado	T. W. Jaycox, State engineer	Denver.
Delaware	Francis A. Price, State highway commissioner, Newcastle County.	Wilmington.
District of Columbia	C. B. Hunt, engineer of highways	Washington, D. C.
Idaho	James Stephenson, jr., State engineer	Boise.
Illinois	Dr. E. J. James, chairman, State highway commission.	Springfield.
	A. N. Johnson, highway engineer, State highway commission.	Do.
Iowa	Prof. A. Marston, dean, division of engineering	Ames.
	T. H. McDonald, highway engineer, Iowa State highway commission.	Do.
Maine	Paul D. Sargent, commissioner of highways	Augusta.
Maryland	Wm. Bullock Clark, State geologist	Baltimore.
	Walter W. Crosby, chief engineer, highway division, geological survey.	Do.
Massachusetts	Harold Parker, chairman, State highway commission.	Boston.
	A. B. Fletcher, secretary, State highway commission.	Do.
Michigan	Horatio S. Earle, commissioner, State highway department.	Lansing.
	Frank F. Rodgers, deputy commissioner	Do.
Minnesota	Gustav Scholle, president, State highway department.	Minneapolis.
	George W. Cooley, engineer, State highway department.	Do.
Missouri	Curtis Hill, State highway engineer	Columbia.
New Hampshire	Arthur W. Dean, State engineer, highway department.	Concord.
New Jersey	Frederick Gilkyson, commissioner of public roads.	Trenton.
	R. A. Meeker, supervisor, State commission of public roads.	Do.
New York	S. Percy Hooker, chairman, department of highways.	Albany.
	T. Warren Allen, commissioner, department of highways.	Do.
	Robert Earl, commissioner, department of highways.	Do.
North Carolina	Samuel L. Patterson, chairman, State highway commission.	Raleigh.
Ohio	James C. Wonders, State highway commissioner.	Columbus.
Pennsylvania	Joseph W. Hunter, State highway commissioner.	Harrisburg.
	R. D. Beman, assistant commissioner	Do.
Rhode Island	John H. Edwards, chairman, State board of public roads.	Providence.
Vermont	Charles W. Gates, State highway commissioner	Franklin.
Virginia	P. St. Julien Wilson, State highway commissioner.	Richmond.
Washington	Joseph M. Snow, highway commissioner	Olympia.
West Virginia	H. E. Williams, State highway inspector	Charleston.
Wisconsin	W. O. Hotchkiss, chief, highway division, geological and natural history survey.	Madison.

STATE OFFICIALS IN CHARGE OF PROTECTION OF GAME.

State.	Name and title	Post-office.
Alabama	John H. Wallace, jr., State game and fish commissioner	Montgomery.
Arizona	W. L. Pinney, secretary, fish and game commission	Phoenix.
California	Chas. A. Vogelsang, chief deputy, board of fish commissioners	San Francisco.
Colorado	Thomas Holland, State game and fish commissioner	Denver.
Connecticut	E. Hart Geer, secretary, commission of fisheries and game	Hadlyme.
Delaware	A. D. Poole, president, Delaware Game Protective Association	Wilmington.
District of Columbia	Maj. Richard Sylvester, superintendent, Metropolitan police	Washington.
Idaho	Wm. N. Stephens, fish and game warden	Rexburg.
Illinois	Dr. John A. Wheeler, State game commissioner	Springfield.
Indiana	Z. T. Sweeney, commissioner of fisheries and game	Columbus.
Iowa	G. A. Lincoln, State fish and game warden	Cedar Rapids.
Kansas	T. B. Murdock, State fish and game warden	Eldorado.
Louisiana	Frank M. Miller, president, board of commissioners for the protection of birds, game, and fish.	New Orleans.
Maine	L. T. Carleton, chairman, commission of inland fisheries and game.	Augusta.
Maryland	Horace F. Harmonson, State game warden	Berlin.
Massachusetts	Dr. George W. Field, chairman, commission of fisheries and game.	Boston.
Michigan	Charles S. Pierce, game, fish, and forestry warden	Lansing.
Minnesota	Carlos Avery, executive agent, board of game and fish commissioners.	St. Paul.
Missouri	James C. Bassford, game and fish warden	Mexico.
Montana	Henry Avare, State game and fish warden	Butte.
Nebraska	Daniel Geilus, chief deputy, game and fish commission	Lincoln.
New Hampshire	Nathaniel Wentworth, chairman, board of fish and game commissioners.	Hudson.
New Jersey	Benedict C. Kuser, president, board of fish and game commissioners.	Trenton.
New Mexico	Thos. P. Gable, game and fish warden	Santa Fe.
New York	James S. Whipple, forest, fish, and game commissioner	Albany.
North Carolina	T. Gilbert Pearson, secretary, Audubon Society	Greensboro.
North Dakota	W. N. Smith, game warden, district No. 1	Grafton.
	Olaf Bjorke, game warden, district No. 2	Abercrombie.
Ohio	Gen. John C. Speaks, chief warden	Columbus.
Oklahoma	Jude Askew, State game and fish warden	Chickasha.
Oregon	R. O. Stevenson, game and forestry warden	Forest Grove.
Pennsylvania	Dr. Joseph Kalbfus, secretary, board of game commissioners	Harrisburg.
Rhode Island	Charles H. Remington, chairman, commission of birds	East Providence.
South Carolina	James H. Rice, jr., secretary, Audubon Society	Spartanburg.
South Dakota	W. F. Bancroft, State game warden	Pierre.
Tennessee	Joseph H. Acklen, State warden of game, fish, and forestry	Nashville.
Texas	R. W. Lorance, chief deputy game, fish, and oyster commissioner.	Austin.
Utah	H. B. Cromar, State fish and game commissioner	Salt Lake City.
Vermont	Henry G. Thomas, fish and game commissioner	Stowe.
Washington	R. C. Bebee, chief deputy State game warden	Bellingham.
West Virginia	J. A. Vignesney, game and fish warden	Belington.
Wisconsin	J. W. Stone, State warden	Madison.
Wyoming	D. C. Nowlin, State game warden	Lander.

ORGANIZATIONS FOR PROTECTION OF BIRDS AND GAME.

Name of organization.	Secretary.	Post-office.
American Ornithologists' Union, Committee on Protection of North American Birds.	A. K. Fisher, chairman	Department of Agriculture, Washington, D. C.
Boone and Crockett Club	Madison Grant	11 Wall street, New York, N. Y.
Camp Fire Club of America	Arthur F. Rice	Flatiron Building, New York, N. Y.
League of American Sportsmen	H. M. Beach	1061 Simpson street, New York, N. Y.
Lewis and Clark Club	J. Bissell Speer	345 Fourth avenue, Pittsburg, Pa.
National Association of Game and Fish Wardens.	Chas. A. Vogelsang	Merchants' Exchange Building, San Francisco, Cal.
National Association of Audubon Societies	Wm. Dutcher, president	141 Broadway, New York, N. Y.
New York Zoological Society	Madison Grant	11 Wall street, New York, N. Y.
North American Fish and Game Protective Association.	E. T. D. Chambers	Quebec, Canada.

OFFICIAL INSPECTORS OF FERTILIZERS IN THE UNITED STATES.

State.	Official title.	Post-office.
Alabama	Commissioner of agriculture	Montgomery.
Arkansas	Commissioner of mines, manufactures, and agriculture.	Little Rock.
California	Director, agricultural experiment station	Berkeley.
Connecticut	do	New Haven.
Delaware	State chemist, agricultural experiment station	Newark.
Florida	Commissioner of agriculture	Tallahassee.
Georgia	do	Atlanta.
Illinois	Secretary, State board of agriculture	Springfield.
Indiana	State chemist, Purdue University	Lafayette.
Kansas	Director, agricultural experiment station	Manhattan.
Kentucky	do	Lexington.
Louisiana	Commissioner of agriculture and immigration	Baton Rouge.
Maine	Director, agricultural experiment station	Orono.
Maryland	State chemist, Maryland Agricultural College	College Park.
Massachusetts	Director, agricultural experiment station	Amherst.
Michigan	Secretary, State board of agriculture	East Lansing.
Mississippi	State chemist	Agricultural College.
Missouri	Director, agricultural experiment station	Columbia.
New Hampshire	Secretary, State board of agriculture	Concord.
New Jersey	Director, agricultural experiment stations	New Brunswick.
New York	Commissioner of agriculture	Albany.
North Carolina	do	Raleigh.
North Dakota	Director, agricultural experiment station	Fargo.
Ohio	Secretary, State board of agriculture	Columbus.
Oklahoma	do	Guthrie.
Oregon	Director, agricultural experiment station	Cornwallis.
Pennsylvania	Secretary of agriculture	Harrisburg.
Porto Rico	Commissioner of the interior	San Juan.
Rhode Island	Chemist, agricultural experiment station	Kingston.
South Carolina	Secretary, board of control	Clemson College.
Tennessee	Commissioner of agriculture	Nashville.
Texas	State chemist	College station.
Vermont	Director, agricultural experiment station	Burlington.
Virginia	Commissioner of agriculture	Richmond.
Washington	State chemist, State College	Pullman.
West Virginia	Director, agricultural experiment station	Morgantown.
Wisconsin	do	Madison.

AMERICAN BREEDERS' ASSOCIATION.

President, James Wilson, Washington, D. C.; vice-president, William George, Aurora, Ill.; secretary, W. M. Hays, Washington, D. C.; treasurer, N. H. Gentry, Sedalia, Mo.; chairman, animal section, O. E. Bradfute, Cedarville, Ohio; secretary, animal section, C. B. Davenport, Cold Spring Harbor, N. Y.; chairman, plant section, H. J. Webber, Ithaca, N. Y.; secretary, plant section, N. E. Hansen, Brookings, S. Dak.

FARMERS' NATIONAL CONGRESS.

President, B. Cameron, Stagville, N. C.; first vice-president, Joshua Strange, Marion, Ind.; second vice-president, L. B. Strayer, Rock Island, Ill.; treasurer, W. L. Ames, Oregon, Wis.; secretary, George M. Whitaker, Washington, D. C.; first assistant secretary, John H. Kimble, Port Deposit, Md.; second assistant secretary, Ralph H. Searles, Fremont, Nebr.; third assistant secretary, O. D. Hill, Kendalia, W. Va.; executive committee, president, secretary, and treasurer, E. W. Wickey, East Chicago, Ind.; Levi Morrison, Greenville, Pa.; A. C. Fuller, Dows, Iowa.

PATRONS OF HUSBANDRY.

OFFICERS OF NATIONAL GRANGE.

Master, N. J. Bachelder, Concord, N. H.; overseer, T. C. Atkeson, Morgantown, W. Va.; lecturer, G. W. F. Gaunt, Mullica Hill, N. J.; treasurer, Mrs. E. S. McDowell, Rome, N. Y.; secretary, C. M. Freeman, Tippecanoe City, Ohio; executive committee, F. N. Godfrey, Olean, N. Y.; C. J. Bell, East Hardwick, Vt.; C. O. Raine, Canton, Mo.; N. J. Bachelder, ex officio, Concord, N. H.

REVIEW OF WEATHER CONDITIONS OF THE YEAR 1908.

By P. C. Day, *Assistant Chief of Climatological Division, Weather Bureau.*

The following weather summary of the year 1908 is prepared in conformity with the plan by which the National Weather Bulletin has hitherto been issued; that is, by months during January, February, and March; by weeks ending with Monday from April to September, inclusive, and again by months during the remainder of the calendar year.

Probably the most remarkable meteorological feature of the year was the severe and long-continued drought which affected the northeastern States during the late summer and the autumn. The drought was felt to some extent in large portions of North Carolina, Tennessee, Missouri, and Iowa, and more severely in all the States to the northward and eastward of these. The dry weather generally set in about the end of July or during August, though many of the afflicted States had received unusually little rain during June and early July, while on the outskirts of the area there were districts which received ample rainfall till after the opening of September.

The lack of rain was the more severely felt because of the abnormally warm weather prevailing during most of the dry period, notably during the latter half of September. It was at this time that the scarcity of water was most widely felt. The drought was mitigated to varying degrees by the irregularly distributed general rains of the last days of September and of the final decade of October, also in a few districts by local rains. In many States there was an ample supply of water from the end of September onward; but in other districts the greatest inconvenience and suffering came during October, or even November; while at the end of the year large portions of the Ohio Valley, Pennsylvania, New York, and New England were still greatly troubled by the scant supply of water. In the Ohio River for some months practically all navigation was suspended, and Lake Champlain in December reached the lowest stage ever known. The occurrence of this drought rather late in the season of crop growth and development did not result in such widespread disaster to agricultural interests as must have resulted had it occurred slightly earlier, but serious inconvenience was caused from the failure of water supplies. Many manufacturing establishments were forced to shut down or seriously curtail their production. The drying up of streams and springs greatly inconvenienced the farmers, who in some districts were obliged to haul for many miles the water needed by their cattle or for use in their households. Scores of cities and towns were greatly embarrassed by the alarming depletion or even the complete exhaustion of their water supply. The dry condition of the forests made possible the occurrence of probably the most disastrous forest fires on record in portions of the Lake region and New England. For long periods in September, October, and November the air in the northeastern States was so filled with smoke that it was impossible to see objects at more than short distances.

The following is a condensed summary of the information collected and published during the year:

JANUARY.

The mean temperature for January, 1908, was above the normal in all parts of the United States, except over a comparatively narrow area extending from the east Gulf coast to West Virginia, where it was normal or slightly below. In the lower Lake region, the Ohio and lower Mississippi valleys, and the Atlantic coast districts the temperature excess was generally less than 3°, and also over the southern Plateau region and along the immediate Pacific coast it was slight; but it was much more decided from the upper Lake region and upper Mississippi Valley westward to Idaho, where it generally ranged from 6° to 15° per day, the greatest excess being shown in the upper Missouri and Red River of the North valleys.

The weather was exceptionally mild on the Pacific coast and in the Plateau region, and from the upper Missouri Valley eastward to New England, except during part of the last decade. In the central and east Gulf States the second and third weeks and the closing days were considerably colder than usual, but the rest of the month was mild.

COLD WAVES.

There were several cold waves, increasing in severity as the month progressed. From the 15th to 17th and from the 22d to 24th cold waves advanced from British America southeastward, bringing freezing temperatures and killing frosts to the greater portion of the Gulf and South Atlantic States, but producing no severe cold in the Mid-

dle-Eastern States. From the 28th to the 31st a well-marked cold wave swept southeastward from the British Northwest Territory, and at the close of the month a severe cold wave was occupying the Northwestern States, and spreading eastward and southeastward.

SCANTY PRECIPITATION.

There was a marked deficiency in the monthly precipitation over the greater part of the country, notably throughout the central valleys, in the middle and west Gulf States, on the north Pacific coast, and over the greater part of the Lake region and New England. The snowfall in the northern districts was unusually light. However, there was more than the usual amount of precipitation over the greater part of California, and also in a strip of territory extending from the east Gulf coast northeastward to the northern portion of the Middle Atlantic States. Also local areas in the Lake region, in southern Florida, and elsewhere, received more than the average amount of precipitation.

The sunshine was below the normal in the central and east Gulf States and in California, but was above the average in all other districts, the percentage being unusually high westward of the Mississippi Valley.

At the close of the month the northern portions of the country were generally covered with snow, while the Appalachian region was covered as far south as northern Georgia; but over most of the Ohio Valley the ground was bare, and depths exceeding one foot were reported only in the upper Lake region and at a few scattered points elsewhere.

FEBRUARY.

The monthly mean temperature during February, 1908, was below the normal in the Atlantic coast and central and east Gulf districts; also over all but the western portions of the Ohio Valley and the Lake region. In the central portions of the Carolinas and the Middle Atlantic States the deficiency was from 4° to 7° per day. Also over the southern Plateau region and along the California and southern Oregon coasts the mean temperature was below the normal. Over the remainder of the country the month was milder than usual, especially over the northern Plateau region, the Missouri Valley, and central Kansas and Oklahoma. The first and third decades were mild generally to the westward of the Mississippi River and cold to the eastward, while the second decade was remarkably mild, except in the Gulf States, and the Plateau and Pacific coast regions. No well-defined and severe cold wave traversed the country, but throughout the first ten days it was continuously very cold in the lower Lake region, the Middle Atlantic States, and New England. From the 18th to 21st a cold wave of moderate intensity advanced over the districts east of the Rocky Mountains, and on the last date brought unseasonably low temperatures to most of Florida.

LOCALLY HEAVY RAINFALLS AND FRESHETS.

The February precipitation was heavier than normal generally throughout the central valleys, in portions of the Gulf States, the Lake region, the Middle Atlantic States, and New England. In large portions of Virginia, the Carolinas, and Georgia, over nearly all of Florida, along the east Gulf coast, over portions of Arkansas, Wisconsin, and Minnesota, and over most of the Plains and Plateau regions and the north Pacific States the amounts were deficient. In southern Arizona and the greater part of California the amounts were unusually large. About the middle of the month the mild weather, combined with rains that were locally very heavy to the eastward of the Mississippi, melted the snow and caused destructive freshets at many points in the central valleys and the Middle Atlantic States. Portions of Mississippi and adjoining States likewise suffered from overflows, where the monthly rainfalls frequently exceeded 8, and at certain points exceeded 10 inches, as also was the case in the Puget Sound region.

LITTLE SNOW PROTECTION.

The northern Rocky Mountain region and the extreme northern districts from the upper Missouri Valley to New England were covered with snow throughout the month, while the greater part of the central valleys and Middle Atlantic States had little or no snow protection during most of the month. At the close of the month the ground was bare along and near the coasts, except in Maine; and the central and lower valleys, and especially all the Plains region, except near the northern border, were practically free from snow. At no stations were depths exceeding half a foot reported, except in the interior of northern New England and New York, in the upper Lake region, and in the mountain regions of the West.

There was more cloudiness than usual in the Gulf and South Atlantic States, but elsewhere the amount of sunshine exceeded the average.

March.

In Maine and along the northern border from Lake Superior to the Rocky Mountains the mean temperature for March, 1908, was about normal; in the middle Plateau region and most of Oregon it was slightly below normal; but over practically all the remainder of the country it was notably above the normal. The month was especially mild for the season in the interior of the South Atlantic and Gulf States, and in Tennessee, Arkansas, Oklahoma, and Missouri.

The first decade averaged colder than usual over the greater part of the Plateau districts, on the middle Pacific coast, and in extreme northern New England; elsewhere the temperature was normal or above, the weather being very mild in the Southern States and central valleys. The second decade averaged milder than usual throughout the country, with the exception of a limited area near Lake Superior; it was exceptionally mild in the northern Rocky Mountain region and generally throughout the Middle Atlantic States, central valleys, and southern portion of the Lake region, and the Southern States. The last decade was somewhat colder than usual in the Plateau regions, but much milder than usual throughout the central valleys and Southern and Atlantic coast States.

The precipitation was in excess of the normal in the upper Ohio Valley, and in large portions of the Lake region, Middle and South Atlantic States, upper Missouri Valley, and western Washington. There was no appreciable amount of rain over much of the southern Rocky Mountain slope, and the precipitation was decidedly deficient also in Florida and along the Gulf coast, in most of Tennessee and Arkansas, in the lower Missouri Valley, on the New England coast, and on the middle and southern Pacific coast. At the close of the month there was no snow on the ground, except to the westward of the upper Lake region.

As a whole the weather during March was mild and favorable, with more than the usual amount of sunshine, over most of the country east of the Rocky Mountains, but there was much stormy weather in the northern Rocky Mountain region and on the north Pacific coast.

The Crop Season, April-September—Summary by Weeks.

By weeks, ending with Monday, from April 13 to September 28, the weather conditions may be summarized as follows:

April 13.—Temperatures were unusually mild in the upper Missouri Valley and northern Rocky Mountain region, and in the interior of northern and central California, also in the Gulf and Middle and South Atlantic States; and they were above normal practically everywhere, except in the southern Plateau and Rocky Mountain slope regions, in portions of the upper Mississippi Valley and lower Michigan, and in northern New York and New England. The southern limit of freezing temperatures was much farther north than usual, though frosts occurred as far south as the Ohio Valley and the interior portions of the Middle Atlantic States.

The rainfall was very heavy in most of southern and central Texas, in eastern Oklahoma, and in southern Missouri; and it was abnormally heavy also in most of New Mexico, in the Ohio Valley, and in a strip extending from Lake Erie westward to South Dakota. There was very little or no rainfall over the greater part of the South Atlantic and east Gulf States, and precipitation was notably deficient also over all districts west of the Rocky Mountains, except New Mexico, and over the northern and middle Rocky Mountain slope. At the close of the week rain was much needed in portions of the South Atlantic and central Gulf States, in Nebraska, and in most of California and Oregon.

There was much cloudiness in the Ohio and central Mississippi valleys and over the northern portions of the west Gulf States; elsewhere there was more sunshine than usual.

April 20.—New England and most of the Middle Atlantic States and the lower Lake region experienced unseasonably cool weather, though only in northern New England and New York was the mean temperature considerably below the normal. Over practically all the remainder of the country the temperature was above the normal, and it was unusually warm in the central Gulf coast region, the upper Missouri Valley, and the northern Rocky Mountain region. From the central Mississippi Valley to the upper Ohio Valley freezing temperatures extended somewhat farther southward than in the preceding week, and light to heavy frosts occurred generally throughout the central valleys and in the coast districts as far south as North Carolina.

HEAVY RAINS CAUSE FLOODS IN TEXAS.

Most of Texas and Oklahoma and portions of Missouri continued to suffer from wet weather, the rains being especially heavy in northern Texas, where they caused damaging floods. In eastern Arkansas and northern Georgia and the adjacent portions of other States the rains were quite heavy. The precipitation was above normal also in several other regions, notably the north Pacific coast region, the lower Lake region, and most of the Ohio Valley and lower Michigan. Beneficial rains fell in portions of Nebraska, but Florida, the upper Missouri Valley, the northern Rocky Mountain region, and the middle Pacific coast remained in need of moisture.

There was more than the usual amount of cloudiness in the lower Missouri Valley and the Southern States, also on the north Pacific coast; elsewhere the sunshine was normal or above.

April 27.—The temperatures were favorable throughout the week in the Middle and South Atlantic and east Gulf States, and the fore part of the week was favorable throughout the Lake region and central valleys, while the latter part was favorable in New England and Texas. However, the latter part was too cool throughout the central valleys and the Lake region, and freezing temperatures occurred in the more northerly portions of these districts, with frosts in the interior of the Middle and South Atlantic States. The mean temperature of the week as a whole was above the normal along the coast of southern California, in southern Idaho, and practically throughout all the region east of the Rocky Mountains; and it was especially high for the season in Michigan, the lower Lake region, and the Ohio Valley, and thence southeastward to the South Atlantic coast.

DESTRUCTIVE LOCAL STORMS IN THE GULF STATES.

But little rain fell anywhere in New England, the Middle Atlantic States, or the lower Lake region, and there was very little or none in western Texas, eastern New Mexico, and Colorado. On the other hand, good showers occurred over most of Nevada, southern California, and western Utah and Arizona. The weekly precipitation was much above the average in the South Atlantic and east Gulf States, in the lower Ohio and central and upper Mississippi valleys, and from the upper Lake region westward to eastern Montana. In most of Georgia and the east Gulf States the rains were very heavy, in places exceeding 6 or even 8 inches and doing considerable damage. Severe local storms also did great injury in portions of the States from Texas to Georgia on the 23d and 24th, and caused the loss of some hundreds of lives. Throughout the central valleys and Lake region high winds were prevalent from the 24th to the 26th.

There was less than the usual amount of sunshine in the east Gulf districts, central Missouri Valley, and northern Rocky Mountain region; elsewhere the amount was generally normal or above.

WEATHER ABNORMALLY COLD.

May 4.—The weather was abnormally cold and unfavorable over much the greater part of the country, especially in the Lake region, the central valleys, and the interior of the Southern States. Freezing temperatures were common in the central and northern Plateau and Rocky Mountain regions, upper Missouri Valley, Lake region, New England, and the interior of the Middle Atlantic States. Heavy frosts were frequent and general, and light frosts occurred as far south as the central and southern portions of the Gulf States and the interior of the Carolinas. In portions of the Ohio and upper Mississippi valleys the deficiency in the mean temperature was as great as 15°; while at several stations in the Southern States lower temperatures than were ever before recorded at this season occurred on April 30 or May 1. On the other hand, the mean temperature was above the normal along most of the Atlantic coast and all the Pacific; also in much of the northern Plateau region.

The precipitation was heavier than usual in the Ohio Valley, most of the lower Lake region, Middle Atlantic States and New England, and portions of eastern Kansas, southern Iowa, and central Illinois. Southern Missouri suffered from excessive rainfall, this being the fourth week in succession with too much moisture. On the other hand, the rains which visited Florida, except the southern portion, were exceedingly beneficial. Likewise the precipitation which fell in northern Arizona and most of Colorado and Wyoming was of great value, though it came mostly in the form of snow. In the Lake region and Ohio Valley, also, snow fell to considerable depths on April 30 and May 1.

The sunshine was normal, or above, in the Southern States and about normal on the Pacific coast; but generally throughout the northern districts east of the Rocky Mountains there was more cloudiness than usual.

COOL WEATHER CONTINUES.

May 11.—The mean temperature was above the normal along the northern border from Lake Superior westward to Idaho, also to a slight degree in the southern portions of Florida and Texas. Elsewhere the week was unseasonably cool, especially throughout a broad belt extending from Colorado and northern New Mexico eastward through the center of the country to the Middle Atlantic coast. Over most of the country the weather was thus unfavorable, and light to heavy frosts were general from the upper Missouri Valley southward to Oklahoma and northwestern Texas, while light frosts occurred as far south as the northern portions of the Gulf States and western North Carolina.

ABUNDANT RAINS IN THE EAST.

Over almost all the eastern half of the country the precipitation was abundant and well distributed. In western Louisiana there was little rain and in portions of the Carolinas and adjoining States there was a deficiency; likewise from Lake Superior westward along the northern border to the Rocky Mountains little or no precipitation occurred. However, in western Montana, northern Utah, and practically all of Idaho, Wyoming, and Nebraska, the precipitation was notably heavy. Practically no rain fell in Texas or the central or western portions of Oklahoma, and in most of the former State rain was needed, as it was also in portions of the upper Missouri Valley.

There was sufficient sunshine in the Southern States and in the upper Missouri Valley; but excessive cloudiness prevailed throughout the central valleys, Lake region, Middle Atlantic States, and New England, where warmth and sunshine were much needed.

COOL IN THE FAR WEST; WARM IN THE EAST AND SOUTH.

May 18.—The week was unfavorably cool in the Pacific States and the Plateau regions; over a large part of the latter freezing temperatures occurred, while light to heavy frosts were general. To the eastward of the Rocky Mountains the week was almost everywhere favorable and warmer than usual. In the central valleys, the southern portion of the Lake region, and the southern Appalachian district the temperature excess was marked. Along the northern border conditions were not quite so favorable, for there was a deficiency in temperature in most of North Dakota, northern Minnesota, and the Lake Superior region, while freezing temperatures occurred in the interior of northern New England and frosts in northern New York during the latter part of the week.

HEAVY RAINS IN THE WEST GULF STATES.

The rainfall was very heavy in the greater part of Mississippi, Arkansas, and Louisiana, and in the eastern portions of Texas and Oklahoma; many localities in these States suffered from overflows and the washing of land. Also in South Dakota and southern Minnesota considerable damage resulted from heavy rains. The rainfall was in excess of the normal in nearly all the northern half of the country from the lower Lakes westward, except in the Plateau region, and generally in the lower valleys and west Gulf States. In the greater part of the Atlantic coast States there was little or no rain, and there was practically none in New Mexico, most of Colorado, and the southern portions of Arizona and California.

The sunshine was below the average on the Pacific coast, generally in the northern districts east of the Rocky Mountains, and in the central and west Gulf States. There was ample sunshine in the lower Missouri, central Mississippi, and Ohio valleys, and generally throughout the Atlantic coast States.

May 25.—The temperature was above the normal and generally favorable over the eastern half of the country and over most of Oklahoma and Texas; elsewhere, save on the coast of California, it was below the normal. It was especially low and unfavorable over the northern Rocky Mountain slope and the Rocky Mountain and eastern portion of the Plateau regions. Light frosts occurred in the upper Missouri Valley, and on the north Pacific coast, and light to heavy frosts and freezing temperatures were common throughout the middle and northern Rocky Mountain and Plateau regions.

EXCESSIVE RAINS; FLOODS IN TEXAS AND ADJOINING STATES.

Very heavy rains fell over the greater part of Texas and Oklahoma, and damaging freshets resulted in those States and in Louisiana. Large portions of Kansas, Iowa, Minnesota, and Illinois were visited by abnormally heavy rains, and the rainfall was generally excessive also along the Atlantic coast from Cape Cod to South Carolina.

In North Carolina this rain was greatly needed. Over much of the northern Rocky Mountain slope the precipitation was notably heavy, most of it falling as snow. There was very little or no precipitation over northern New England, much of the Lake region, the east Gulf coast, and the far Southwest. There were severe local storms in the western portion of the upper Lake region, in Texas, and in portions of the South Atlantic States during the fore part of the week.

There was much cloudiness in the Atlantic coast districts northward of Georgia, in Texas, and from the upper Lake region westward to the north Pacific coast; elsewhere there was more than the usual amount of sunshine.

WARM THROUGHOUT THE EAST; COOL IN THE WEST.

June 1.—The temperature was above the normal from Texas northeastward to Lake Michigan and in practically all districts to the eastward, the greatest excess occurring in the Middle Atlantic States. Elsewhere the week was unseasonably cool, especially in the northern Plateau region. Freezing temperatures and frosts occurred in portions of the middle and southern Plateau and Rocky Mountain regions.

SNOW FALLS IN NEVADA AND WYOMING.

No rain, or practically none, fell in western Texas and thence westward to the Pacific, in most of North Dakota, along much of the Gulf coast, and in central and western North Carolina; also in most of the southern Appalachian region, the Ohio and lower Mississippi valleys, and western Oklahoma and Kansas the rainfall was decidedly scanty. Limited areas in North Carolina and Arkansas needed rain. On the other hand northern Missouri, Iowa, and southern Minnesota suffered considerably from excessive rains. Other regions receiving an excess of precipitation were southwestern New England, the coast counties of North Carolina, and portions of Arkansas, Kansas, Montana, and northern Utah. Snow occurred over much of Nevada and some counties of Wyoming, and heavy snow occurred in the high mountain districts of Montana and Idaho. In the mountains of California the supply of snow left from the preceding winter was decreasing rapidly, and in the mountains of Arizona there was decidedly less snow than at the corresponding date of 1907, yet the flow of water still continued plentiful.

Throughout the northern districts local storms of considerable severity were numerous during the latter part of the week.

There was ample sunshine in the Ohio Valley, Atlantic coast and central and east Gulf districts, and from Texas westward to the south Pacific coast; but the amount of cloudiness was more than usual in the Lake region and in the districts westward of the upper Mississippi Valley.

LONG-CONTINUED COOL WEATHER IN THE PLATEAU DISTRICTS.

June 8.—The week was unseasonably cool and generally unfavorable in the upper Missouri Valley, the Rocky Mountain region, and all districts to the westward, except that the last days were very warm on the north Pacific coast. In the upper Ohio Valley and along the Atlantic coast from South Carolina northward the first days of the week were abnormally cool, and the mean temperature of the whole week was somewhat below normal. Freezing temperatures occurred at a few points and frosts were general in the interior of New England and New York; and light frosts were reported also from a few counties in Ohio. Freezing temperatures occurred also over a large part of the central and southern Plateau regions, a temperature of 23° being recorded at Flagstaff, Ariz., on the morning of June 4. The greatest deficiency in temperature occurred in the Plateau region, especially in the central portion, where a few stations reported deficiencies of 12° or more. In the Lake region, upper Mississippi Valley, central and lower valleys, central and southern portions of the Plains region, and throughout the Gulf States the mean temperature was normal or above, the greatest excess occurring in the upper Lake region.

There was no appreciable rain throughout most of California, Arizona, New Mexico, and southern Texas; also in most of southern Michigan, northern Ohio, Pennsylvania, New Jersey, New York, and New England, except a few counties in Maine. In the greater part of Indiana, Illinois, and Wisconsin, and portions of Arkansas, the Carolinas, and the east Gulf States the rainfall was very light. Much of western Tennessee and of central Virginia, also portions of adjoining States and practically all of eastern Florida, received rain in considerable excess; but the chief regions of excessive precipitation during the week were a strip extending northward from extreme northern Texas through the eastern portions of Oklahoma, Kansas, Nebraska, and South Dakota, and including

much of the States adjoining these on the eastward, and a large region in Montana and Idaho. This was the fourth successive week to bring excessive precipitation to much of Montana, and destructive floods in many of the small streams of that State resulted. Also the lower Arkansas Valley and other portions of Oklahoma and eastern Kansas, and districts in Missouri, northern Mississippi, western Tennessee, and eastern North Carolina suffered from overflows. Some severe local storms occurred in the upper Missouri and upper Mississippi valleys, but comparatively few elsewhere. Again snow fell in portions of Nevada and in the mountains of Idaho, and heavy snow in the high mountains of Montana.

There was much cloudiness in Oklahoma, Kansas, Missouri, and generally to the westward of the upper Mississippi Valley, also in most of the South Atlantic States; elsewhere the sunshine was normal or above.

FROSTS IN THE DAKOTAS AND UPPER LAKE REGION.

June 15.—The weather averaged somewhat warmer than usual in the north Pacific coast and northern Plateau regions and most of Nevada, New Mexico, and Texas, and throughout almost all the area of the Atlantic coast States. Elsewhere the mean temperature was abnormally low, and the week was especially cool in the Dakotas, Minnesota, Iowa, and western Wisconsin. Light frosts occurred in the Dakotas and the upper Lake region during the middle of the week.

DAMAGING FLOODS IN THE ARKANSAS VALLEY.

There was practically no rain in the Pacific States, Arizona, New Mexico, southern and western Texas, and along the immediate Atlantic coast from Chesapeake Bay northeastward. Rain was much needed in western and southern Texas, over much of the Ohio Valley, and generally throughout the Middle Atlantic States and New England, the drought being severe in the last-named district. The rainfall was general but light this week in the upper Lake region, but it was notably heavy in Wyoming and Nebraska; and it was especially heavy in eastern Kansas, Oklahoma, and large portions of Missouri, Arkansas, and Louisiana. Damaging overflows occurred in the lower Missouri and Arkansas valleys.

There was much cloudiness in the lower Missouri and upper Mississippi valleys and upper Lake region, also in portions of the Southern States; elsewhere the amount of sunshine was unusually great, notably in New England and the Middle Atlantic States.

COOL WEATHER IN THE FAR WEST.

June 22.—A marked feature was the unseasonably cool weather over the greater part of the Rocky Mountain, Plateau, and Pacific coast regions, the temperature deficiency being greatest in Idaho and the adjacent portions of surrounding States. Frosts occurred in portions of Washington, Montana, and Arizona. During the fore part of the week it was very cool also throughout most of the central valleys and thence eastward to the Atlantic coast, frosts being reported from portions of Illinois and Ohio. But for the week as a whole the temperatures east of the Rocky Mountains everywhere averaged not far from normal, except that in eastern New England it was unusually warm.

The rainfall was somewhat excessive in most of Oregon, Idaho, Montana, Wyoming, and Nebraska, and in the northern portions of Utah and Colorado; also it was especially excessive in northern North Dakota, northwestern Iowa, and portions of South Dakota and Kansas. Florida, especially the southern end, received heavy rains; and highly beneficial rains fell in portions of southeastern Texas, and most of Ohio and New England. Practically no rain fell in the vicinity of Lake Michigan, or from the lower Ohio Valley southward to central Mississippi and Alabama. Severe local storms visited portions of Ohio, Wisconsin, and Minnesota, and caused some damage in the last-named State, but the week as a whole was comparatively free from such storms.

There was much cloudiness in the north Pacific coast States and portions of the upper Mississippi Valley; but elsewhere there was generally abundant sunshine.

COOL WEATHER CONTINUES IN THE WEST.

June 29.—As in previous weeks, the weather was unseasonably cool in the northern Rocky Mountain and Plateau districts, with some frosts and freezing temperatures; and the mean temperature was generally below the normal to the westward of the Mississippi River, except in Arkansas and Louisiana, along the southern border, and in Cali-

fornia near the coast. Also throughout most of the South Atlantic and east Gulf States the mean was slightly below the normal. In other districts the week was warmer than usual, the excess being most notable in the upper Lake region.

SEVERE DROUGHT IN NEW ENGLAND, THE OHIO VALLEY, AND ELSEWHERE.

The rainfall was heaviest over southern Minnesota, northern and western Missouri, southeastern Kansas, southwestern Oklahoma, most of the Florida peninsula, and limited areas in Texas, the Carolinas, and Connecticut and Massachusetts. The rain was somewhat excessive for the season also in northern New Mexico, much of Arizona and Utah, along the coast of Washington, in most of Wisconsin, and in eastern Georgia. In California, Nevada, and most of Idaho no appreciable rain fell; and the same was true of most of Tennessee, northwestern Mississippi, northern Louisiana, and much of Arkansas. The drought continued with increasing severity in the greater portion of New England, in southeastern Alabama, southeastern Pennsylvania, and generally throughout the Ohio Valley, in Tennessee, and in much of Louisiana. On the other hand, in some portions of the Carolinas there was flooding and washing of lands on account of the excessive rains.

Destructive local storms occurred in parts of Virginia and Minnesota, and high winds caused some local damage in Utah; yet for a week in summer the country as a whole was remarkably free from damage of such character.

A deficiency in sunshine was reported from South Carolina and North Dakota, and from a few other districts. Elsewhere the amount of sunshine was generally ample and in some cases excessive.

HEAVY RAINS IN NEBRASKA; HAIL IN KANSAS.

July 6.—The mean temperature for the week was below the normal, as in the preceding week, over the entire district between the Mississippi River and the Rocky Mountains, except southwestern Texas. The lower Mississippi Valley had weather but very slightly cooler than usual in July, but in the middle Missouri Valley the week was unseasonably cool, the deficiency amounting at places to 9° a day. Light frosts were reported from exposed localities in Wyoming and Montana. The week averaged warmer than usual along the southern border from the Gulf of Mexico to very near the California coast, also generally in the Pacific coast States, Nevada, Arizona, and the western portions of Utah and Idaho. Also in the lower Lake region, most of Ohio, West Virginia, and Alabama, and in all the Atlantic coast States save Florida, the mean temperature was above the normal.

The precipitation was decidedly heavy in eastern Nebraska, and rather heavy in many other small districts, especially in the Carolinas and Georgia, and along the west Gulf coast. It was generally somewhat above the normal also over the central and southern portions of the Rocky Mountain slope, in South Dakota and thence southeastward to Indiana, and in much of the Ohio Valley, Tennessee, and Mississippi, and in portions of Florida, the Virginias, and lower Michigan. There was little or no rain along the northern border from Lake Superior westward, in western Arkansas and eastern Oklahoma, in most of New England and northern New York, and generally along the immediate coast of the Middle Atlantic States. Practically no rain fell anywhere in the districts west of the Rocky Mountains, but water for irrigation purposes was generally plentiful.

Some damage was sustained by hail in Kansas, and hail and wind storms occurred locally in Wyoming and New Mexico.

Considerable cloudy weather prevailed over the Dakotas, Nebraska, Iowa, and Wisconsin, and in the lower Mississippi Valley, but elsewhere there was generally abundant sunshine.

WIDESPREAD HOT DRY WEATHER.

July 13.—The week was generally favorable as to temperature and sunshine. Over most of the districts east of the Rocky Mountains the week opened with comparatively warm weather, which was followed by several days cool for midsummer. The end of the week brought temperature generally above the normal, especially over the Atlantic coast districts, where intensely hot weather prevailed on the 12th. The mean temperature for the whole week was above the normal over practically all the northern half of the country, also over substantially all of California, Nevada, Utah, and Arizona, and along the central and east Gulf coast and in most of Florida. The excess was marked in northern and eastern New England, and in Montana, Idaho, Washington, and Oregon. In no district was there a marked deficiency in temperature.

There was unusually little precipitation. An abundance of rain fell only in scattered districts, generally small; these were chiefly in the Carolinas and Georgia, in portions of Mississippi and the west Gulf States, in the central and lower Missouri Valley, and in southwestern Nevada and the interior of California. Irregularly distributed rainfall, locally quite abundant, was reported from the region of Lake Michigan, from northern and eastern Ohio, and from the interior of New York. Very heavy rains occurred at some places in southern Louisiana, while there was no rain at all in most of New England and the lower Ohio Valley. At the close of the week the drought continued with increasing severity over most of New England, and rain was badly needed also over the Atlantic coast districts as far south as Virginia, and westward over the Ohio Valley to Illinois, in North Dakota, and generally in unirrigated districts west of the Rocky Mountains.

Frequent sandstorms occurred in Arizona, and in North Dakota some damage from hot winds was reported, while in scattered localities in Wyoming, Utah, Arizona, and New Mexico some injury was done by hail.

The sunshine was somewhat deficient over the lower Mississippi Valley, and in Colorado, New Mexico, and portions of Texas; but the amount was excessive in most of the Plateau and Pacific States.

BENEFICIAL RAINS IN NEW ENGLAND.

July 20.—Conditions were generally normal as to both temperature and sunshine. Periods of moderately cool and warm weather succeeded each other at frequent intervals, and no great extremes of either heat or cold occurred. The average temperature was slightly above the normal along the Atlantic and Gulf coasts and in the central and lower valleys and the southern Appalachian region; also in the Pacific States and thence eastward along the northern border to central North Dakota. Elsewhere the week averaged cooler than usual for July, especially in the Lake Superior region and northern Minnesota.

Heavy and general rains over most of New England relieved the droughty conditions that had prevailed there, and along the Middle Atlantic coast beneficial rains fell. However, these rains were unevenly distributed, and some localities were left in great need of further moisture. Considerable rain fell in most of the Lake region and the upper Ohio Valley, in portions of Georgia, Florida, and Alabama, along the coast of Louisiana, and in most of Missouri and the upper Mississippi Valley. Quite heavy rains occurred in north-central Kansas, eastern Oklahoma, and central Arizona; and less heavy ones in portions of North Dakota, Montana, and eastern Oregon. There was no rain, or very little, in most of Virginia and the Carolinas, in western Tennessee and portions of the adjoining States, in most of the interior of the west Gulf States and the coast districts of southern Texas, in most of South Dakota and Nebraska, and generally westward of the Rocky Mountains, except in districts previously mentioned. Some severe thunderstorms were reported, especially from Ohio, and slight damage from hail was reported from portions of Ohio, Wyoming, and Idaho.

Sunshine was generally abundant, though deficiencies were noted in portions of Arizona, Colorado, Nebraska, western North Carolina, and northern Florida; also in parts of Texas, Idaho, and the Lake region.

DROUGHT BROKEN IN MIDDLE ATLANTIC STATES.

July 27.—The week was one of generally even and moderate temperature, the average being slightly above normal over more than half of the country. The mean was especially high over the upper Missouri Valley, where high maximum temperatures occurred on the 25th. The regions where the week averaged cooler than seasonable for July were New England and northern New York, the east Gulf States, most of the central and lower valleys, and from Kansas and Oklahoma southwestward to extreme southern California. As a rule temperatures were favorable, though the humid conditions prevailing over most of the eastern districts during the latter portion of the week produced considerable discomfort.

The rainfall was decidedly heavy over most of New England and New York, especially the southern portions, also over the greater part of New Jersey, Pennsylvania, Maryland, West Virginia, and northern and western Virginia. The greater part of this region had been without sufficient rainfall for several weeks. There was considerable rainfall over most of the Ohio Valley and the cotton-growing States, save large portions of Texas and the coast sections of the Carolinas. Heavy rains occurred in northwestern Iowa and southern Minnesota, and less heavy ones over eastern Kansas and most of Nebraska, and in southeastern Nevada, southern Utah, and northern Arizona. Practically no rain fell in the upper Lake region, and lower Michigan and southern Wisconsin were in much need of moisture.

Severe thunderstorms, with heavy rain, high winds, and damage by lightning, occurred during the latter part of the week in portions of New York, New Jersey, Pennsylvania, Maryland, and Ohio.

Sunshine was generally abundant over all western and many eastern districts, though considerable cloudy weather prevailed over New England, the Middle Atlantic and west Gulf States, and in Oklahoma, eastern Kansas, and portions of Arizona.

August 3.—The week was slightly cooler than normal in Maryland, Virginia, and the Carolinas, and generally throughout an area along the southern border and the Gulf coast from central Arizona to western Florida, extending northward to central Colorado. Elsewhere the mean temperature was close to or above the normal, frequently to a marked degree. The regions of greatest excess were northern New York and New England, the upper Lake region, and especially the interior of California and northwestern Nevada. Low morning temperatures were reported this week, as in the preceding, from northern Idaho. The week closed with high temperatures over the central valleys.

WEATHER GENERALLY DRY; HEAVY RAINS IN LIMITED AREAS.

The precipitation was practically confined to a few districts, but in some of those districts it was locally very heavy. Abundant rain fell in the coast districts of Virginia and the Carolinas, where it was much needed; but in part of North Carolina the great excess of rain, combined with high winds, caused a great amount of damage. In most of Louisiana and Mississippi and the adjacent coasts of Alabama and Texas there was very heavy rain; and in southern Louisiana much flooding occurred, over 19 inches of rain falling in St. Mary Parish. There was a fair rainfall in eastern Minnesota and the Lake Superior region, and in a narrow strip from southwestern Iowa to south-central Kansas, and in a small region in the Dakotas. But the largest area of precipitation was in the far Southwest, extending from southern Nevada northeastward to western Nebraska and southeastward to central Texas. A few stations in this area reported falls very heavy for the region—Modena, Utah, over 2 inches; Flagstaff, Ariz., almost 3 inches; and Amarillo, Tex., nearly 4 inches. There was no rain, or extremely little, in the Pacific coast States, Idaho, northern Montana, much of New England and the Middle Atlantic States, and, except as noted above, in the Lake region.

Sunshine was generally deficient over most of Louisiana, Utah, Arizona, Colorado, New Mexico, the northwestern portion of Texas, and the coast districts of the east Gulf and South Atlantic States.

NORMAL TEMPERATURES; WELL-DISTRIBUTED RAINS.

August 10.—The week was generally favorable as to temperature and sunshine. Some high day temperatures prevailed over nearly all northern and eastern districts during the first of the week, but cooler weather followed. Over the interior portions of the Pacific coast States the week continued decidedly warm, and there were some excessively hot days. Nowhere in the country did the mean temperature of the week depart widely from that usual early in August, except as already noted. In Montana and most of Wyoming, and generally to the westward of the Rocky Mountains, save in southeastern Arizona, the week averaged warmer than normal; also in most of the Lake region, New York, New England, Pennsylvania, and the South Atlantic States, the mean temperature was a trifle above normal.

There was very little rain, or none at all, in the States along the northern border from upper Michigan to the Pacific coast or anywhere to the westward of the Rocky Mountains, save in Utah and Arizona, the southeastern portions of California and Nevada, southern Wyoming, and northern Colorado, where moderate rains fell. In western Oklahoma and northern and eastern Texas, also in most of Wisconsin, Illinois, and Indiana, there were few districts where rain occurred in amounts more than trifling; but in central and southwestern Texas there was considerable rain, though unevenly distributed. In almost all districts not named above rain came in considerable amounts, and the distribution was more even than usual for a week in summer. The chief regions of the heaviest rainfall were central and eastern Arkansas, southern Missouri, southwestern Kentucky, northern Mississippi, Alabama, and Georgia, most of North Carolina, and central New England. In much of the central and southern portions of lower Michigan the drought was broken by terrific thunderstorms, and there was much damage by lightning, as there was also in Pennsylvania and New England.

There was more cloudiness than usual over most of the far Southwest, the central cotton-growing States, and much of North Carolina and New England.

COOL IN THE NORTHWEST.

August 17.—In the upper Missouri Valley and northern Rocky Mountain region the week averaged much cooler than normal, especially the closing days; and generally to the westward of the Mississippi River, except from southern Iowa and northern Kansas southward to the Gulf of Mexico, the mean temperature was unseasonably low. However, in much of Oklahoma and Texas this was the first week since the latter part of June when the temperature did not average below normal. Over practically all districts east of the Mississippi the mean temperature was somewhat, though nowhere decidedly, above the normal; and on the 14th and 15th very high temperatures were prevalent. Unusually low temperatures were recorded in the Mountain and Plateau districts near the end of the week.

RAIN IN THE CORN-GROWING STATES.

The rainfall in southern Florida was heavy, also in portions of Arkansas, Kentucky, Virginia, and North Carolina; but in general there was but very little rain to the southward of Nebraska, Iowa, the Ohio River, northern Pennsylvania, and central New England. But in these regions and to the northward, save in the Lake Superior region, there was a plentiful amount of rain, and in a strip extending eastward from the central Missouri Valley across Iowa and lower Michigan to western New York, the fall was decidedly heavy. In Montana, Wyoming, most of Colorado and Utah, northern and eastern Arizona, and all of New Mexico the precipitation was large; but to the westward there was practically none, except on the immediate north Pacific coast.

In northern Arizona this was the fourth week of excessive rain, and much damage from floods resulted. Some damage from hail and high winds occurred in the Dakotas, Ohio, and Utah. The severe drought in portions of Wisconsin, Illinois, Indiana, and Ohio was now almost everywhere broken, but portions of the cotton-growing States were much in need of moisture.

The sunshine was somewhat deficient in amount from the upper Lakes and the central Missouri Valley westward to the Rocky Mountains and in nearly all districts throughout the Rocky Mountain and Plateau regions.

LIGHT FROSTS IN NORTHERN DISTRICTS.

August 24.—Throughout the cotton-growing States, most of the Ohio Valley, and most of the middle Atlantic coast the week averaged a trifle warmer than normal; also in most of the Pacific States and the northern Plateau region there was an excess, amounting in most of Oregon and Washington to 5° or more. In the remainder of the country the mean temperature was below the normal, especially in the upper Mississippi and middle Missouri valleys and eastern Colorado. In the Missouri Valley and thence southward to the Gulf of Mexico, also eastward to the upper Ohio Valley, the fore part of the week was warm and the last part much cooler. The week was warm in the east Gulf States and cool in New England and the northern Middle Atlantic States. Generally cool weather during the latter part of the week brought the first light frosts of the season in the agricultural districts, from the Dakotas eastward to the Great Lakes, and at a few localities in Ohio, northern New England and the higher portions of the Middle Atlantic States, on the 20th and 21st. No material damage was done by these frosts. In contrast with these low temperatures was the unusually high temperature of 102°, at Roseburg, Oreg., on the 17th.

ABUNDANT RAINS IN THE COTTON-GROWING STATES.

In marked contrast with the preceding week, the precipitation was abundant in most of the cotton-growing States, and almost entirely lacking in the regions to the northward of these States. Good rains fell in Connecticut and southeastern New York, also generally in the Virginias, southwestern Pennsylvania, and southeastern Ohio; but there was practically no rainfall elsewhere to the eastward of the Missouri River. In the Southern States the fall was scanty in a few districts, notably in the Florida Peninsula, extreme western Texas, and portions of Arkansas; but the rain was very heavy from central Georgia northward to central Virginia. In southwestern Louisiana and southeastern Texas, and locally in the Carolinas, some damage resulted from the excess. A moderate amount of rain fell in southwestern Missouri and southern Nebraska, and a larger supply in Kansas and most of Colorado, especially in north-central Kansas. To the westward of the Rocky Mountains there was some precipitation in portions of the northern and southern Plateau regions, but elsewhere practically none. At the end of the week rain was needed in western

New York, the greater part of Pennsylvania, and generally in tne Ohio, middle and upper Mississippi, and Missouri valleys.

The sunshine was generally ample from the Dakotas eastward, including most of the Mississippi and Ohio valleys, and it was sufficient over the Plateau and Pacific coast districts. There was a general lack of sunshine over the greater part of the Gulf States, along the eastern slope of the Rocky Mountains, and over portions of the Great Plains from Nebraska to Texas, and in the Atlantic coast States from Georgia northward to Virginia.

August 31.—In general the temperature conditions were quite the reverse of those of the preceding week. Unseasonably cool weather prevailed to the eastward of Lake Erie, and over the western portions of Ohio, Tennessee, and Mississippi, also in the upper Missouri Valley, the western portions of Wyoming and Utah, and generally to the westward of these regions and of the lower Colorado River. Elsewhere the temperature conditions were favorable, the mean being slightly above, or at least very close to, the normal. There was a great deficiency in the mean temperature, amounting to from 6° to 10°, in a district extending from central Georgia to southern New England, and in another district embracing Idaho, northern Nevada, and the interior of Oregon and Washington. During the first part of the week light frosts occurred at exposed points along the northern border from the upper Lakes to Maine, and later in the week in the northern portions of the Rocky Mountain and Plateau districts; but no material damage resulted.

HEAVY RAINS IN THE ATLANTIC STATES.

The rainfall was very unevenly distributed. Heavy rains occurred in the southeastern portions of New York and Pennsylvania, and generally throughout the other Atlantic coast States from Massachusetts southward. The rains were exceedingly heavy in southern Virginia, northeastern Georgia, and most of the Carolinas, in places exceeding 12 inches; great floods resulted, causing immense damage and some loss of life. The rainfall was general but light in southern Georgia, northern and western Florida, northern and western Alabama, and the cotton-growing States to the northward and westward, save portions of Louisiana and central and southeastern Texas. In the part of the country not yet mentioned the largest region of rainfall was a strip extending from southern New Mexico to northwestern Illinois, southwestern Wisconsin, and southern Minnesota. There was considerable rain also in North Dakota and northwestern Minnesota, and in Washington and northwestern Oregon. Localities of excessive rain were the northern portion of the valley of the Red River of the North, southern Iowa, northwestern Missouri, and south-central Kansas. There was no appreciable precipitation during the week in California and Nevada, most of Oklahoma and western Texas, and the Ohio Valley, Lake region, and northern New England.

From the Appalachian Mountains westward there was generally an abundance of sunshine, save in Iowa and Nebraska and near the North Pacific coast; but along the Atlantic coast and in the eastern portion of the cotton belt there was a decided deficiency of sunshine.

WARM, DRY WEATHER PREVALENT.

September 7.—The week opened with decidedly cool weather prevailing over the upper Missouri Valley; the area moved rapidly eastward, bringing light to heavy frosts at exposed places in several northern States. Also light to killing frosts occurred in the elevated portions of some far-western States. Yet for almost all the country the temperature of the week as a whole was warm and favorable, being somewhat in excess of the normal, though decidedly in excess only in the northern Plateau region. The two chief regions of deficient mean temperature were an area extending from extreme western Texas to eastern Iowa, and an area from central Ohio, central Tennessee, and northwestern Georgia eastward to the coast of the Carolinas and the Middle Atlantic States; but the deficiency was nowhere more than slight.

There was practically no rain anywhere between the Missouri River and the Rocky Mountains, or to the westward of those mountains, save that light rains fell on the coast of Washington, in portions of Nevada, and in southern California. Also in eastern Texas and in most of the Ohio Valley and Lake region there was but very little rain, if any. There was much rain in Oklahoma, especially the central part; and less heavy rain in large portions of the adjoining States. Some rain occurred in southern Texas, and more along the immediate Gulf coast to the eastward of Texas. There was a considerable fall over the southern Appalachian region, and along the immediate Atlantic coast from the Savannah River to Cape Cod. The rainfall was locally very heavy in Alabama and Florida; and in much of eastern North Carolina the fall was heavy enough to cause some damage.

Even in the regions of heaviest precipitation there was almost everywhere abundant sunshine, and over most of the corn and cotton growing States the amount of sunshine was decidedly in excess.

UNUSUALLY WARM IN MOST DISTRICTS.

September 14.—Along and near the coast from Delaware Bay to the mouth of the Mississippi River the week averaged slightly cooler than usual at this season; also on the coast of Washington and Oregon, in the central and southern Plateau region and the Rio Grande Valley the mean temperature was close to the normal, generally a trifle above it. But in practically all the remainder of the country the week was unusually warm for the season, notably in the upper Mississippi and middle and upper Missouri valleys. At some stations in the Dakotas the mean temperature for the week was 12° or more above the normal.

DROUGHT IN THE NORTHEAST; TORRENTIAL RAIN AT JACKSONVILLE, FLA.

No rain whatever was reported from most stations in Virginia and Tennessee and the States to the northward and northeastward; also from Illinois westward to central Colorado and along the coast of California. Local rains occurred at a few places in South Dakota and Minnesota; but otherwise the only precipitation of any moment was in a narrow district extending along the South Atlantic and Gulf coasts, including all of Florida, and extending northward through eastern Texas to central Oklahoma, where light to moderate showers fell. The rainfall was exceedingly heavy in a small area around Jacksonville, Fla., where over 13 inches were recorded, and quite heavy in a somewhat larger area on the coasts of Louisiana and eastern Texas. The drought had become very severe over most of Pennsylvania, New York, and New England, especially Vermont, also generally in the Ohio and upper Mississippi valleys, and in much of the Lake region. Streams were low and the ground had become exceedingly dry.

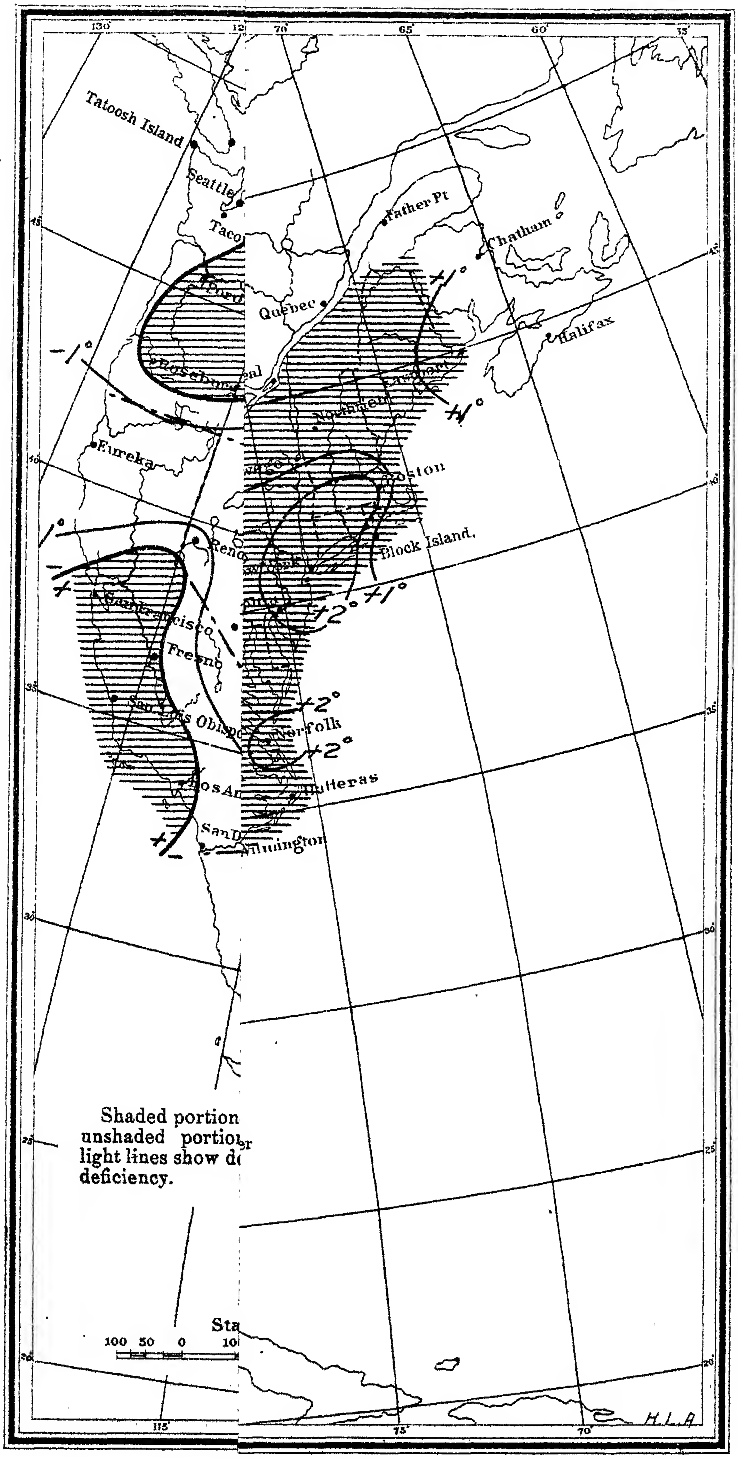
Sunshine was almost everywhere ample, and generally far above the average in amount; but considerable smoke prevailed in the Lake region, Pennsylvania, New York, and New England.

WARM WEATHER CONTINUES.

September 21.—Conditions continued almost exactly as during the week preceding. Over northern New York and New England, along the Atlantic coast from New Jersey southward, including substantially all of Virginia and the Carolinas, in most of Texas and Nevada, and in the greater part of the Pacific coast States the week averaged cooler than normal, though only in the great valley of California was the deficiency marked. Over the remainder of the country the week was unseasonably warm, the excess in temperature being very notable in the western part of the Lake region and the Missouri and middle and upper Mississippi valleys. At Moorhead, Minn., the week averaged 18° warmer than normal. Some frosts occurred at exposed points, but no material damage resulted.

FOREST FIRES IN THE GREAT DROUGHT AREA.

Again there was no rain whatever at practically all places in Virginia, Kentucky, northern Missouri, Iowa, and to the northward and eastward of these States, save in upper Michigan and portions of northern Minnesota. In upper Michigan light showers checked to some extent the forest fires prevailing there, but in general the intense heat and long-continued drought were favorable to the further development of such fires. The drought continued, with increasing severity, in the districts which were suffering in preceding weeks, and the afflicted area extended farther southward and westward, so as to include most of North Carolina, Tennessee, Nebraska, and South Dakota. The only regions where precipitation was more than very light were a small area in western South Dakota and the adjoining States, a larger area including western Montana and most of Idaho, and an area covering extreme southern Kansas and much of the cotton-growing region. Even over most of Oklahoma and Arkansas, the adjoining portions of other States, and in northern Mississippi and northwestern Alabama the rainfall was comparatively light; but nearer the Gulf and in most of Florida the amounts usually exceeded an inch. As during the preceding week there were excessive rains in the coast districts of Louisiana and eastern Texas. At Galveston over 12 inches had fallen within a fortnight. There was no rain over most of extreme western Texas, New Mexico, Arizona, and southern California, or over the greater part of the Carolinas, northeastern Georgia, and eastern Tennessee.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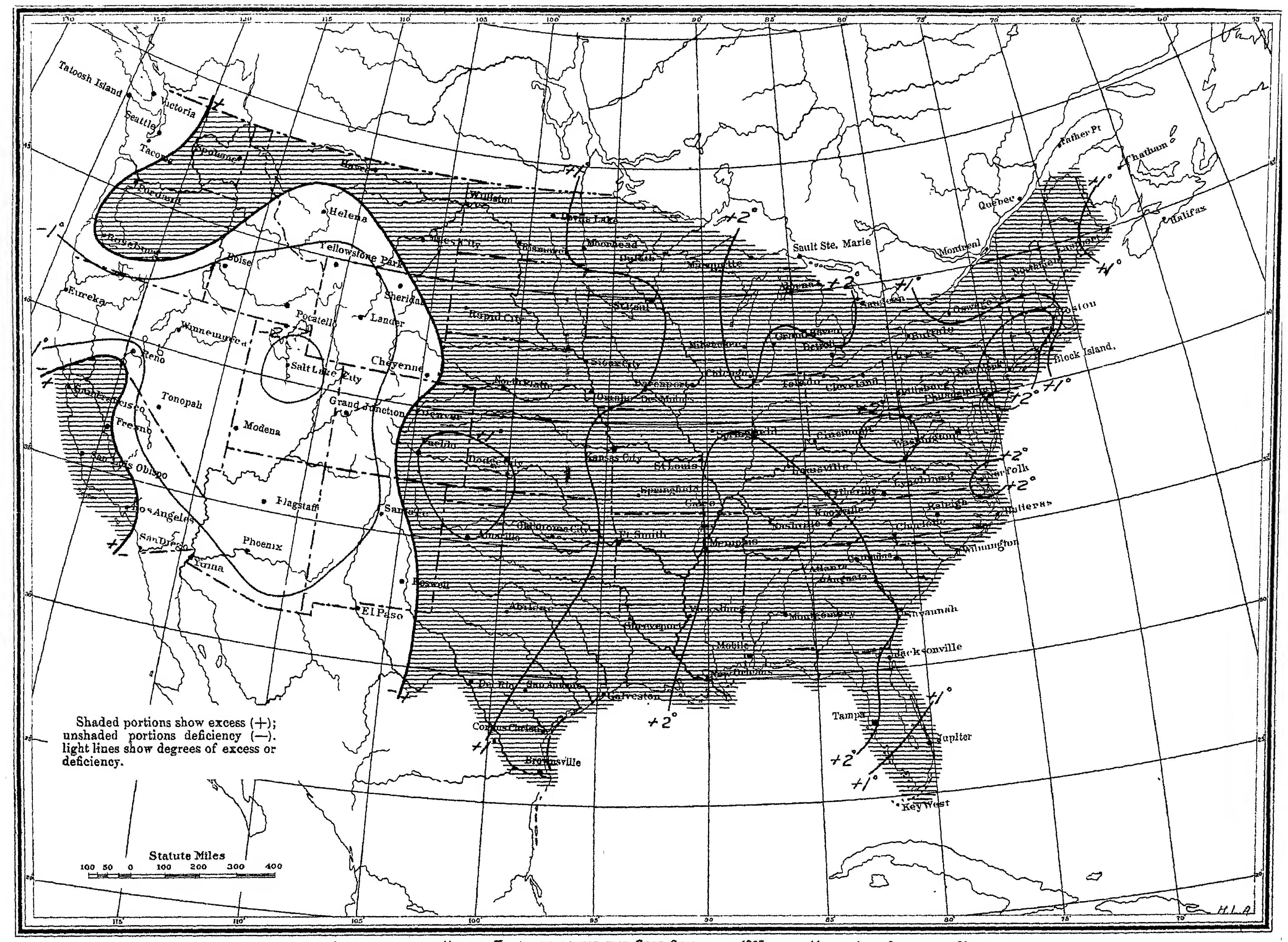
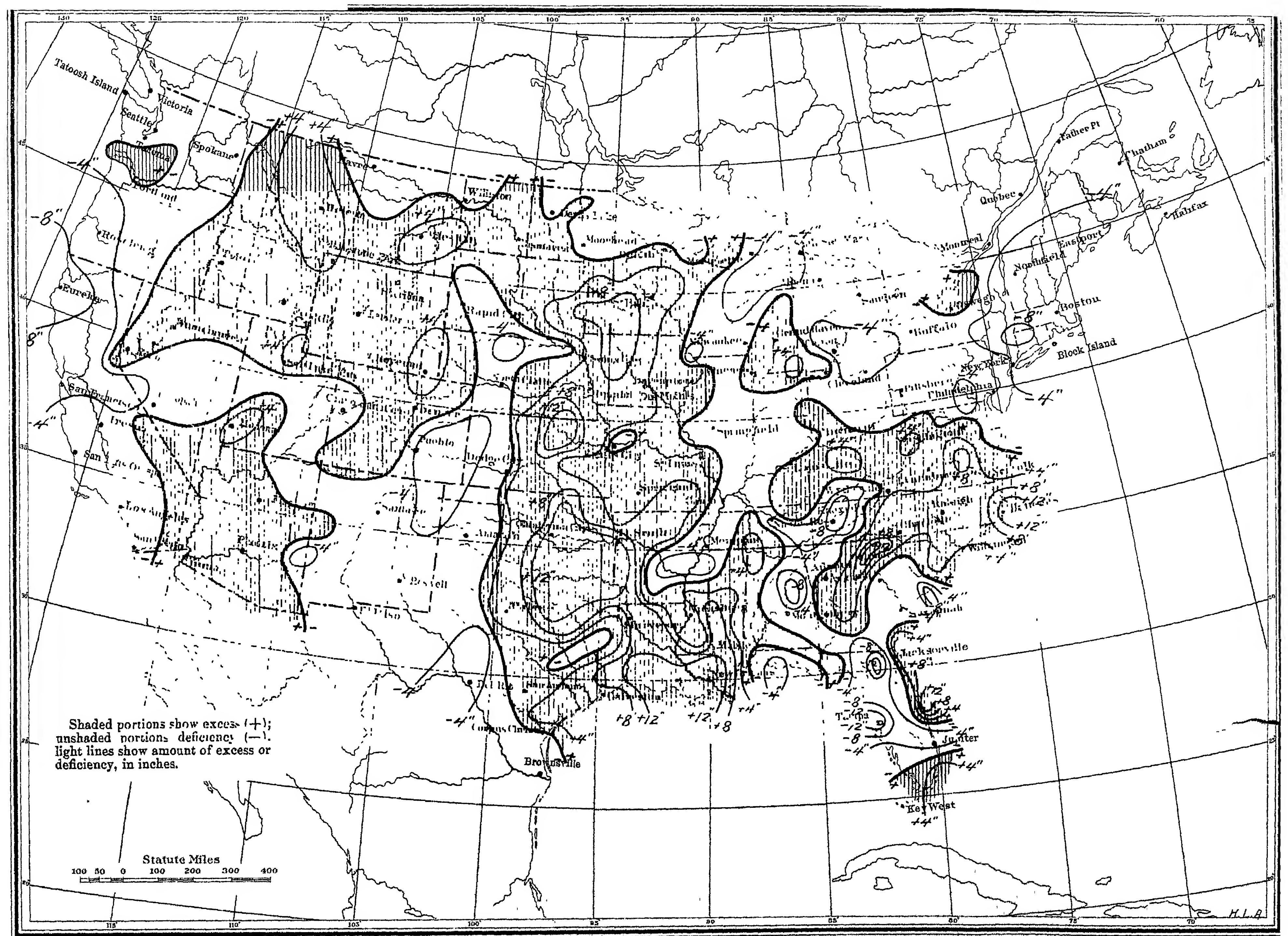
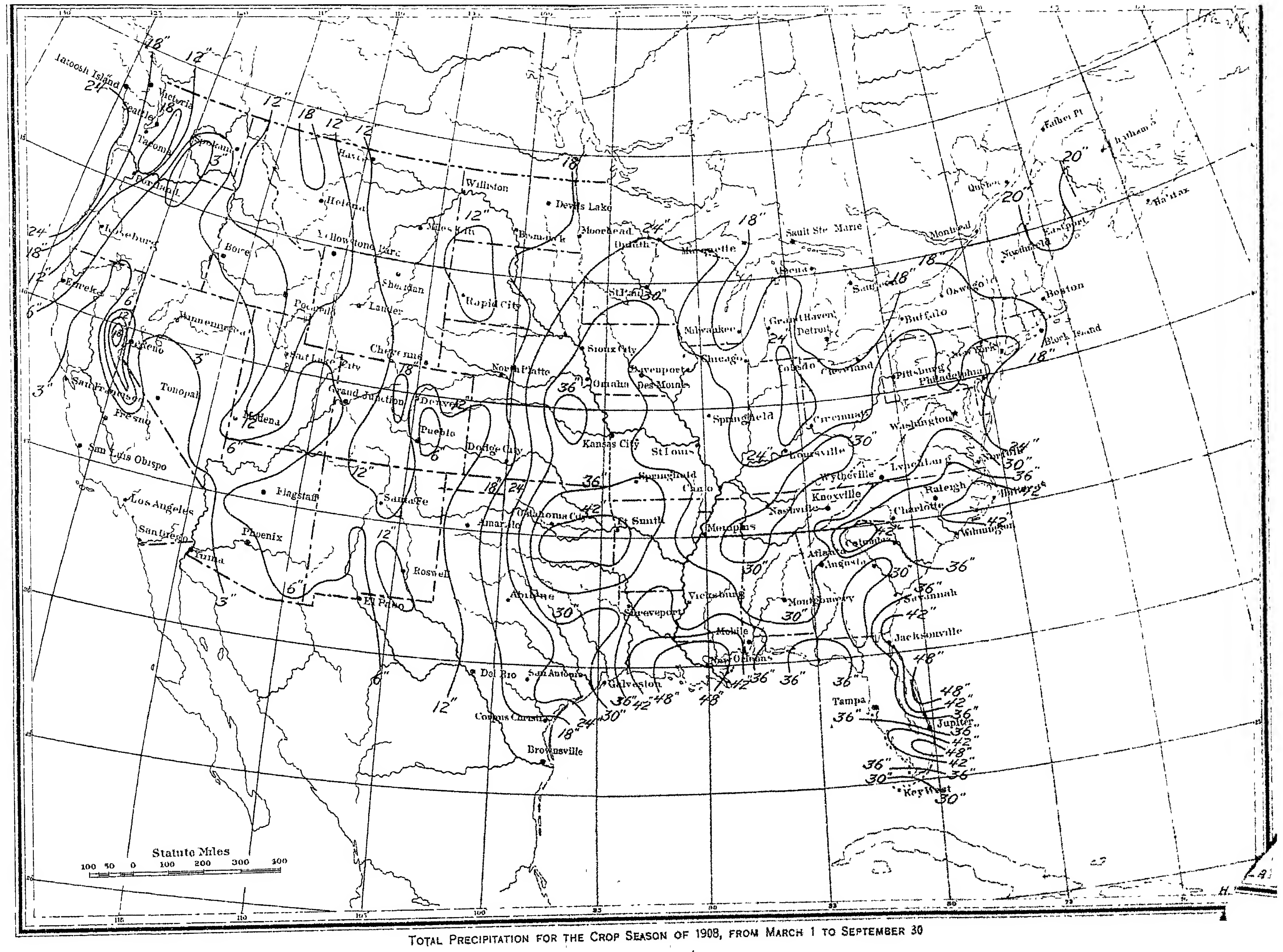


Departures from Normal Temperature for the Crop Season of 1908, from March 1 to September 30.



DEPARTURES FROM NORMAL PRECIPITATION FOR THE CROP SEASON OF 1908, FROM MARCH 1 TO SEPETEMBER 30.



Total Precipitation for the Crop Season of 1908, from March 1 to September 30

The sunshine was abundant over nearly all districts, especially over the corn belt and the Atlantic States; but light to dense smoke was noted in the Lake region and thence eastward over New York and New England, also southward to the Virginias and Illinois.

SHARP OVERTURN IN WEATHER CONDITIONS.

September 28.—The intensely hot, dry weather which had for several weeks been prevailing over the greater part of the country continued till near the end of the week, when a decided change began over the North Pacific region and steadily extended eastward. By the morning of the 23th decidedly cool weather had set in as far east as Michigan, Indiana, Kentucky, and Alabama. For the week as a whole the temperature averaged above the normal over most of California, Texas, and Arkansas, and all of Louisiana, and in the middle and lower Missouri Valley, and everywhere east of the Mississippi River. The excess was especially large in the interior of New York and New England, the Ohio Valley, and the entire Lake region; in portions of the latter district the average temperature of the week was 16° warmer than usual at the close of September. In most of Kansas and Oklahoma and in all the Rocky Mountain, Plateau, and north Pacific regions the mean temperature was below the normal, the deficiency being greatest in the middle and northern Plateau districts. Freezing weather occurred toward the close of the week over the more northern districts west of Lake Superior, while light to killing frosts had extended, by the 28th, as far southward as the Panhandle of Texas and as far eastward as northern Wisconsin. In most of the corn-growing States this was the fifth consecutive week of abnormally hot, dry weather; but in portions of the Middle and South Atlantic coast States this was the first week for about a month when the mean temperature had been as high as normal. In the latter part of the week unseasonably cold weather was experienced almost everywhere to the westward of the Mississippi River, except in California, and the prospects favored the extension of this cold weather to all eastern districts.

Up to the morning of the 28th no rain had fallen in the greater part of New York and New England, or in most of Oregon and northern California; and though the rain area was advancing eastward the week had brought practically no precipitation to the eastward of Lake Michigan, central Kentucky and Tennessee, and eastern Mississippi, except that showers had fallen in the South Atlantic States, giving large amounts in southeastern Georgia and much of Florida. Moderate to heavy rains had fallen throughout a broad belt including the entire course of the Mississippi, and extending westward to the eastern portion of the Dakotas and the western portions of Kansas and Texas. The falls were decidedly heavy in much of Minnesota and western Wisconsin, in most of Oklahoma and central and eastern Arkansas, and in the coast district of Louisiana. Near the coast of southern California the precipitation was quite heavy, and severe electrical storms, wind squalls, and hail, such as are very rare in that district, were reported at many places. The precipitation was decidedly heavy also in most of Utah, where locally it caused some damage; and rather heavy, falling largely as snow, in central and northwestern Colorado, most of Wyoming, central and eastern Montana, and western North Dakota.

Sunshine was generally deficient in the Gulf States and portions of Georgia and the Carolinas; but elsewhere it was usually abundant. However, in the States affected by drought the air was very smoky, on account of forest fires, until the advent of the rains in the regions they reached before the end of the week; while in many of the Atlantic coast States the mornings were usually foggy.

Review of the Season.

For the period from March 1 to September 30 the mean temperature was below the normal over practically all of the Rocky Mountain and Plateau regions, also the coast districts of Washington and scattered portions of California. The deficiency was most notable in Utah and in the adjacent portions of other States. The mean temperature was above the normal in much the greater part of the country, namely, in most of the coast districts and in the great valley of California, in Oregon, eastern Washington, the eastern portions of Montana and Colorado, and practically everywhere farther eastward. The departure from the normal was very slight in the middle Missouri Valley, central and western Virginia, and at several points immediately on the Atlantic coast; but the excess was quite considerable, amounting to about 2° to 3° per day, on the shores of Lakes Huron and Michigan, and in most of the Ohio Valley, the east Gulf States, and the southern Appalachian region. (Pl. L.)

The total precipitation during the same period was deficient over almost all northern districts east of the Mississippi, over most of South Carolina, eastern and southern

Georgia, the Florida peninsula, and the east Gulf States; also over the greater part of Tennessee. To the westward of the Mississippi there was a deficiency generally over the middle and upper Missouri Valley, southeastern Colorado, and western Kansas, and in the Pacific coast States. The regions of most marked deficiency were the greater part of California, where, however, the normal spring and summer rainfall is very small, eastern Washington, most of Michigan, save the southwest portion of the lower peninsula, and central and northern New England. On the other hand, very notable excesses in precipitation occurred in Arizona, Utah, and Oklahoma, southern Montana, eastern Kansas, western Arkansas, and northwestern Texas, and on the coast of North Carolina. In Oklahoma and western Arkansas the amounts exceeded 150 per cent of the normal quantities, and the same was true in Utah and in southern Montana, where, however, the normal falls are very much less. In general, the rainfall was somewhat in excess of the normal in southern Virginia, most of North Carolina, northern and western Georgia, portions of Florida, practically all of Louisiana, portions of the coast regions and the southwestern districts of Texas, around the southern end of Lake Michigan, and in most of Iowa, Minnesota, Idaho, and northern Nevada. (Pls. LI, LII.)

October.

During the first half of the month the weather was generally cooler than seasonable in the eastern half of the country, also in most of the northern States of the western half, and throughout the central and southern Plateau region, though in the Lake region, New York, and New England warmer weather set in about the 10th or 12th. On the immediate Pacific coast the mean temperature of the first half of October was about normal, and over much of the Great Plains region it was somewhat above. Generally in the central valleys, the cotton-growing States, and the southern Plateau region there was a considerable deficiency in the temperature of the first two weeks.

During the last half of the month the weather was warm for the season in practically all the country to the eastward of the Mississippi River, and especially in the more northern districts, till the last few days, when a decided change to colder weather occurred. However, in the South Atlantic and east Gulf States the temperature varied somewhat, and in many districts averaged cooler than normal. In the western portion of the cotton-growing region there was about a week of cold weather at the end of the month. In the more northern States between the Mississippi and the Rocky Mountains the last half of the month was about as mild as usual, or, especially in Montana and Wyoming, somewhat cooler. To the westward of the Rocky Mountains, except in Idaho and the immediate vicinity of the Pacific coast, the latter half of the month was rather cooler than usual.

For the month as a whole the mean temperature was above the normal in a small portion of California, a larger area in northern Idaho and the adjoining States, and generally to the eastward and northeastward of the Missouri and Cumberland rivers and central North Carolina; it was below the normal over the remainder of the country, most notably in the east Gulf States and the central and southern portions of the Rocky Mountain and Plateau regions.

Freezing weather and killing frosts extended as far south as central Texas, the lower Ohio Valley, and southern New England, but as a rule the lowest temperatures were confined to the last days of the month.

SCANTY RAINFALL.

Much the greater part of the country had very little rain during October. In the Appalachian Mountains and to the eastward there was a fair amount, especially in the Carolinas and southern Virginia, but practically all of it to the northward of Virginia fell after the 24th. In Florida the precipitation was generally much less than normal, except in the southeastern portion. The monthly total at Jupiter was 20.43 inches. In the Lake region and the Ohio and Mississippi valleys, except Minnesota, the precipitation was decidedly deficient. The chief region of heavy rains was a narrow strip extending from north-central Texas to central Iowa, a region which had generally received much more than its usual amount of rain during the seven preceding months. In portions of central Oklahoma and eastern Kansas the monthly rainfall exceeded 8 inches, and some damage resulted. In Nebraska and the Dakotas, notably in South Dakota, and thence westward to the Pacific, including northern Colorado, eastern Nevada, and all of Utah, the amount of precipitation was almost everywhere in excess of the normal. In Montana and the higher portions of the other States most of the precipitation fell as snow, much of it coming during the second decade. This heavy snow, combined with the unusually cold weather, caused some loss of and considerable suffering to live stock in the Rocky Mountain regions. Remarkably heavy

snow for the season fell also in northeastern Kansas and northwestern Missouri during the last decade.

The droughty conditions which had prevailed so generally in the central Mississippi Valley and to the eastward during most of September, though somewhat relieved by the general rains near the end of that month, were continued during the greater part of October, till the rainfall of the last week; and, indeed, in portions of New England and Pennsylvania, and generally throughout the Lake region, the Ohio Valley, and the central Mississippi Valley, and the western half of Tennessee, there was very little relief during any part of October, and at the end of that month the water supply was alarmingly low and there was most urgent need of rain.

There was much smokiness, as in September, in all northeastern districts, but otherwise there was the normal amount of sunshine, or considerably more, to the eastward of Kansas and Oklahoma, and on the immediate Pacific coast. But in the Plateau and Rocky Mountain regions, also during the latter half of the month in the Dakotas, Kansas, and Oklahoma, there was an unusual amount of cloudiness.

November.

To the eastward of the Rocky Mountains the weather was generally favorable, though somewhat changeable. The month began with four to six days of cold weather, followed by about a week of mild weather. About the middle of the month a short, but severe, cold spell followed; then, about the 16th to 18th, a warm period began, which lasted till the close of the month, save that during the last day or two a cold wave set in over the upper Missouri Valley and adjacent districts. In the Rocky Mountain region and to the westward the first decade was generally warmer than normal, especially on the immediate Pacific coast; the second decade was colder than usual in the southern Rocky Mountain region, but generally milder elsewhere; and the third decade was generally colder than normal, especially in Utah and, after the 23d, in Colorado.

For the month as a whole the mean temperature was below the normal only in the central and southern Rocky Mountain regions, the southern Plateau region, extreme western Texas, and the greater portions of Utah and southern California. Elsewhere much warm weather occurred, and the average was above the normal, notably in the central and upper Missouri and Mississippi valleys.

By far the greater part of the country received less rain than November usually brings. The chief localities of excessive precipitation were southeastern Florida, where again the rainfall was remarkably heavy, though most of the remainder of the State was suffering from drought; an area including the lower Missouri Valley and the Ozark region, with southern Kansas and eastern Oklahoma; an area including northwestern Iowa, western Minnesota, and most of the Dakotas, especially east of the Missouri River; an area covering central and northeastern Colorado with southwestern Nebraska and northern New Mexico; and an area embracing northern Utah with the adjacent portions of other States. In the two areas last mentioned the bulk of the precipitation came in the form of snow and during the final week of the month. The precipitation was fairly abundant, though generally less than normal in amount, over the Pacific coast region from central California northward, in most of Illinois, Kentucky, and Tennessee, in portions of Texas, and in much of the Lake region, especially the more northern part.

Over most of the Middle Atlantic States and the upper Ohio Valley, with adjoining portions of the Lake Erie region and New England, the precipitation was quite scanty, and the droughty conditions generally continued. Also generally throughout the Gulf States there was decidedly little rainfall. The rainfall exceeded 6 inches only in three very small areas—in extreme southwestern Missouri and the adjoining portions of other States, on the southeastern coast of Florida, and in part of the Puget Sound region.

From the mountain districts of North Carolina northeastward to New Jersey an unusually heavy snowfall for the season occurred on the 13th, 14th, and 15th. In most of North Dakota, Colorado, and northern Utah the snowfall was abnormally heavy, but in the mountains of Montana it was only moderate, and generally elsewhere in the more northern States rather light. Yet at the end of the month the ground was generally covered over the upper Missouri Valley, and in the Rocky Mountain and Plateau regions as far southward as northern New Mexico.

Some severe electrical storms occurred in portions of the Lake region on the 24th and 25th, while tornadoes visited a few localities in northwestern Arkansas on the 23d, causing loss of life and much damage to property. Smoky conditions remained in some sections till at least the middle of the month, and heavy fogs were frequent in the Middle Atlantic States, especially during the last decade. In the country as

a whole the sunshine was generally ample, though deficiencies were reported in New York, South Carolina, and, especially during the closing days of the month, in most of the region between the lower Mississippi Valley and the Southern Plateau region.

DECEMBER.

In the country east of the Rocky Mountains the first decade was characterized by two cold waves and the closing days by a third, but the last one had not reached the eastern States when the month closed, and the second one was not severely felt in the more northeastern States. Except during the passage of these cold waves and on a few other days, notably portions of the third decade in the Southern States, the sections east of the Rockies had decidedly mild weather. Very high temperatures for December occurred on the 1st along the Atlantic and east Gulf coasts, and about the middle of the month in several of the cotton-growing States. In the Rocky Mountain region and to the westward the first decade was marked by cold weather in the northern and eastern portions, but about normal or a trifle warmer elsewhere; the second decade was generally very cold, notably the last few days, except that in New Mexico it averaged warmer than normal; the third decade was generally much milder than usual, except in northern California, where it averaged unusually cold, and in Utah and western Colorado, where low temperatures prevailed during the first days of the decade.

The mean temperature for the whole month was below the normal in eastern New England, the Lake Superior region, and generally to the westward of the Rocky Mountains, except in the Southern Plateau region. There was no area of marked deficiency save a narrow strip extending from the central California coast to southern Utah. Over all the remainder of the country the month was warmer than usual, especially in the lower Missouri Valley and on the east Gulf coast.

Over the States east of the Mississippi the precipitation, while generally less than the normal amount, was usually more plentiful and more evenly distributed than for several months preceding. The chief regions of considerable deficiency were the coast districts from Louisiana to southern North Carolina and the greater portions of Illinois, Indiana, and western Kentucky. The rainfall was somewhat excessive in northern Mississippi and Alabama and in eastern Tennessee, and slightly excessive precipitation was recorded in a few other scattered districts. In the larger part of Oklahoma and northwestern Texas there was no precipitation whatever, and generally to the westward of the Mississippi River there was much less than an inch. The chief exceptions were southeastern Arkansas, interior Louisiana, and small portions of eastern and central Texas, the Pacific coast region from central California northward, and an area embracing Arizona, western Colorado, and portions of Utah and Wyoming. On the north Pacific coast the amounts, though at places large, nowhere exceeded the fall usual in December. Indeed, the only considerable region west of the Mississippi which had precipitation above the normal amounts extended from southeastern California northeastward, including practically all of Arizona, northwestern New Mexico, eastern Utah, western and north-central Colorado, and most of Wyoming and South Dakota. In northern Arizona and southwestern Colorado the amounts were very large for the region, and most of the precipitation fell as snow about the middle of the month, while in southwestern Arizona heavy rains and damaging floods occurred at this time. An unusually heavy snowstorm for the region prevailed over the interior and mountain portions of Virginia, and thence northeastward over Maryland, southern Pennsylvania, and New Jersey during the 22d and 23d; in portions of Virginia the depth exceeded a foot. There was less snow than usual over the mountain districts from Wyoming northward, but at the close of the month the ground was generally covered in the Rocky Mountain region, except in central and southern New Mexico, also in North Dakota, most of Minnesota and Wisconsin, the upper Lake region, northern New York, and the interior of New England; and localities in the Middle Atlantic States and lower Lake region reported small amounts.

At the end of the month precipitation was still much needed to replenish the water supply in interior portions of New England, New York, and Pennsylvania, and in most of the Ohio Valley.

The greater part of the country had ample sunshine, but more cloudiness than usual was reported from New England, the Virginias, South Carolina, Arkansas, North Dakota, and the southern Rocky Mountain and Plateau regions, while fog was prevalent over much of Oregon, California, and eastern Texas.

PLANT DISEASES IN 1908.

By W. A. Orton, *Pathologist in Charge of Cotton and Truck Diseases and Plant Disease Survey*, and Adeline Ames, *Scientific Assistant, Bureau of Plant Industry.*

This article continues a series that has appeared in the nine preceding Yearbooks, giving the distribution and prevalence of plant diseases in the United States and the progress made in their treatment.

From a small beginning these articles have grown with our facilities for securing information until it seems advisable to issue hereafter annually a bulletin of the Bureau of Plant Industry containing the data of interest mainly to specialists, and to publish here only a summary of the year's events of general interest and importance.

VEGETABLE AND FIELD CROPS.

Bean.—The dry summer prevented the development of anthracnose, which has done much harm in the Eastern States in previous years. Bacterial blight was very common on both leaves and pods, and was this year the cause of most of the injury referred to by growers as "rust."

The work of Prof. H. H. Whetzel, of Cornell University, is developing the fact that a practicable method of securing anthracnose-free seed is through selection of seed from perfectly clean pods. He finds that the use of such healthy seed is the most effective way of preventing the disease. The use of seed grown in Western States where anthracnose is less prevalent is also suggested. Picking seed by hand to remove diseased beans has been found useless, and spraying gave very unsatisfactory results. (See Bulletin 255, Cornell University Agricultural Experiment Station.) Southern bean growers should also consult Bulletin 101 of the Louisiana Experiment Station, Baton Rouge, by Prof. H. R. Fulton, which discusses these bean diseases and two others prevalent in the lower South—one a decay of ripe pods and blighting of bean stems due to a sterile fungus (Rhizoctonia), the other a wilting and yellowing caused by the attack on the stems and roots of another fungus (*Sclerotium* sp.), distinguishable by its abundant formation of small, round, white to brown resting bodies or sclerotia. This disease attacks nearly all vegetables grown in the Gulf States, though not ordinarily serious except in old gardens. The use of fungicides applied to the soil around the plants is advised. Professor Fulton describes in detail a wilt of pepper caused by this fungus.

Cabbage.—Downy mildew (*Peronospora parasitica* (Pers.) De By), a disease of young cabbage plants in seed beds, has apparently caused an unusual amount of harm in Florida and South Carolina, where spraying with Bordeaux mixture will be required to hold it under control.

Cotton.—Anthracnose, or boll-rot, is the cause of greater losses than are generally appreciated. During the past season, as in several previous years, it has been very uneven in its prevalence, destroying from 5 to 70 per cent of the crop in various cases. In the Mississippi Valley abnormally heavy rains caused large losses from this disease and from other forms of boll-rot, black-arm, etc. Good progress has been made in the control of cotton wilt through dissemination of the resistant varieties developed by this Department. Farmers' Bulletin 333 on cotton wilt gives full information on this disease and its control.

Cucumber.—Downy mildew was quite injurious in Florida and at Norfolk and other points on the Atlantic coast. Spraying with Bordeaux mixture proved an effective preventive at the Virginia Truck Experiment Station, and also when applied to cantaloupes for leaf-blight, resulting in a large increase in yield. The methods of spraying recommended are described in Farmers' Bulletin 231.

Potato.—Owing to the abnormally dry season there was practically no late-blight this year in the great potato-growing States, and only a few reports from central Pennsylvania, as a result of wet weather in July.

Early-blight was not very prevalent in most localities. Apparently the moist early summer predisposed potatoes in Ohio to later injury from early-blight and tip-burn.

The principal injury resulted from tip-burn, induced by the dry weather, and this with associated injuries from flea-beetles and other insects greatly reduced the crop.

In view of the absence of diseases, the results from spraying with Bordeaux mixture were most significant. The New York Agricultural Experiment Station increased the yield 39 bushels per acre with six sprayings, while 14 farmers spraying under its

direction made an average profit, after deducting all expenses, of $8.53 per acre. Equally striking figures were secured by the Vermont station, showing conclusively that it pays to spray potatoes every year, whether the blights appear or not.

Potato wilt, or dry-rot, is an important factor in the western potato industry. The soils of the interior valleys in Colorado, Oregon, California, and adjacent States become so infected after a few crops of potatoes are grown that further continuous cropping is unprofitable. This fact, hitherto attributed by growers to the exhaustion of some element of fertility, is now attributed to the wilt. Rotation of crops is apparently the best remedy for this condition.

Potato scab is also serious in these western sections. Some of the scab appears to be attributable to Rhizoctonia, but much is the same as the eastern scab. Most growers fail to disinfect their seed and as a result the trouble is on the increase. Circular 23 of the Bureau of Plant Industry has just been issued to call attention to these diseases and to give directions for the treatment on a large scale of potatoes for the prevention of scab.

Sugar Cane.—In Bulletin 100 of the Louisiana Experiment Station, Prof. H. R. Fulton has recently described a root disease of sugar cane that has been doing considerable damage in that State. The cause is shown to be a fungus (*Marasmius plicatus* Wak.) of the mushroom family. Preventive measures are fully outlined, comprising cultural precautions, selection of sound canes for planting, the use of Bordeaux mixture for disinfecting the canes planted, the use of resistant varieties, the destruction of infected trash, and the rotation of crops. Freedom from loss may be secured by these means.

Tobacco.—Bacterial wilt was quite injurious in western Florida and in the Granville district of North Carolina. Bulletin 141, Part 2, of the Bureau of Plant Industry, by Dr. Erwin F. Smith, contains suggestions to growers for the prevention of this disease.

Tomato.—Owing to the exceptionally dry season tomatoes suffered more than for many years with the peculiar form of decay known as point-rot. This emphasizes the close connection of this disease with soil conditions, though its full nature is not yet known.

Sugar Beet.—Curly-top, a disease marked by "small curled and more or less roughened leaves, thickened crown, hairy roots, dark fibro-vascular bundles," etc., has caused heavy losses in the Western States for several years. It has been very erratic in its occurrence, "seldom appearing two consecutive years in the same locality." The cause has remained uncertain until the past year, when the experiments of Mr. H. B. Shaw, of the Bureau of Plant Industry, verified the conclusions previously reached by Dr. E. D. Ball, of the Utah Agricultural Experiment Station, that the diseased condition is induced by the punctures of a leaf hopper (*Eutettix tenella* Baker). The life history of the insect is described in Bulletin 66, Part IV, of the Bureau of Entomology. The comparatively slight injuries inflicted by this leaf hopper produce a physiological disorder in the beet, from which it appears to be seldom able to recover.

Leaf-spot continues to spread westward. It has done considerable damage in the Eastern and Middle States, but the work of Dr. C. O. Townsend has shown conclusively that it may be controlled by spraying with Bordeaux mixture.

Watermelon.—This crop suffered badly in the southern commercial melon-growing districts from a premature blighting of the leaves due to anthracnose. This disease has been gaining headway during recent years and may require active remedial measures to be taken in the future.

FRUITS.[a]

Apple.—The disease known as apple fruit-blotch and leaf-spot (*Phyllosticta solitaria* E. and E.) has been on the increase in Virginia, West Virginia, Maryland, and southward to Tennessee and Georgia for the last three or four years, and has come to be the most serious pest in southern orchards. It is due to a fungus which causes small spots on the leaves, disfiguring blotches and cracks on the fruit, and cankers on the twigs. The attack as leaf-spot east of the Allegheny Mountains last year was more severe than ever. The fruit-blotch, previously little known as a serious trouble and confused with scab by many growers, has been studied by W. M. Scott and J. B. Rorer, of this Bureau, who have found that it is from the twig cankers that most of the fruit infections come. The disease is widely scattered through the southern apple belt

[a] Prepared with the assistance of Messrs. M. B. Waite and W. M. Scott.

from Maryland and the Carolinas to Arkansas and Missouri. In portions of the Ozark region, 75 per cent of the fruit has been affected by it each year since it has gained such headway. Fortunately, Messrs. Scott and Rorer have found that it can be entirely controlled by thorough spraying with Bordeaux mixture, the most important application being made three to four weeks after the petals fall. Six sprayings will suffice for the combined treatment of all the serious troubles, including blotch, bitter-rot, scab, codling moth, and cankerworm. Full details may be found in Bulletin 144 of the Bureau of Plant Industry.

Prof. Charles Brooks, of the New Hampshire College Agricultural Experiment Station, has shown that two diseases have been confused under the name of Baldwin fruit-spot, or physiological fruit-spot. One disease is marked by the occurrence of dead brown spots under the skin of the apple and scattered through the flesh, which, although most frequent on Baldwins, also occur on many other varieties. This is due to physiological causes, perhaps indicating a lack of adaptation of the variety to the soil or locality, especially the inability of the plant to supply water to the tissues as fast as needed.

Professor Brooks shows that in New Hampshire more spotting of apple fruits is due to a fungus (described by Brooks as *Cylindrosporium pomi*). This produces spots distinguishable from those of the other disease by their darker color and restriction to the surface of the fruit. This fruit-spot can be controlled by spraying with Bordeaux mixture, while the other can not.

Apple scab prevailed throughout the Middle West in the worst epidemic yet reported, destroying several million dollars' worth of fruit and causing marked defoliation of the trees. Cool, rainy weather was largely responsible for this condition. Continued rains made it impossible to properly spray many orchards in Missouri and Illinois. Experiments conducted by Mr. W. M. Scott, of this Department, in Arkansas and Nebraska resulted in almost complete control of the disease, the percentage of healthy fruit from sprayed trees being 96½, as compared with 1½ per cent from unsprayed trees. There was a marked development of apple scab late in the season in New England and New York. Considerable losses were also caused there by the development of scab after apples were stored.

An unprecedented attack of orange-rust occurred in the commercial apple orchards of Virginia and West Virginia, particularly in the Shenandoah Valley, during the past season. It has usually attacked severely only certain varieties, such as Pryor's Red, but during the past season it attacked the York Imperial, Ben Davis, and other commercial varieties so as to be seriously injurious to them.

Peach.—Brown-rot was bad locally in Georgia, especially on late varieties and in fertile orchards. Elsewhere it prevailed to a moderate extent, but was not epidemic. The outlook for the control of this destructive disease is much more promising since the discovery by Mr. W. M. Scott, of the Bureau of Plant Industry, that efficient lime-sulphur compounds can be prepared which are not injurious to tender foliage like that of the peach.

The self-boiled lime-sulphur mixture has proved remarkably effective against black-spot and brown-rot of the peach, apple scab, and cherry leaf-spot. It is destined to great usefulness in spraying fruits liable to injury by Bordeaux mixture, but is not yet recommended as a substitute where the latter can be used with safety.

Factory-boiled lime-sulphur preparations now on the market also promise to be effective and safe if sufficiently diluted. Circular 27 of the Bureau of Plant Industry gives the latest advice on the preparation and use of these new fungicides, and details some striking results obtained from their use in the Department's experiments of the past season.

Attention is also directed to the new formula for an iron Bordeaux mixture recommended by Prof. A. D. Selby, of the Ohio Agricultural Experiment Station, in Bulletin 199. This mixture, which excels in its adhesiveness to foliage, is made from copper sulphate (blue vitriol), 2 pounds; iron sulphate (copperas), 4 pounds; quick-lime, 6 pounds, and water sufficient to make 50 gallons.

Peach leaf-curl was very much more severe than usual from New York to Illinois, owing to the cool, wet spring.

Peach yellows continues to prevail in an epidemic condition throughout the central-eastern peach districts, but shows a tendency to subside.

Grape.—Black-rot was quite serious on unsprayed vineyards in Michigan and northern Ohio, but was less prevalent in New York. Spraying with Bordeaux mixture has been conclusively proved by Mr. C. L. Shear, of this Department, to be an effective preventive of this disease, the numerous failures reported by growers all proving to be due to lack of thoroughness and improper preparation of the Bordeaux

mixture. See also Bulletin 253 of the Cornell University Agricultural Experiment Station.

CITRUS FRUITS.—Physiological troubles of the orange and other citrus fruits, due to unfavorable soil, etc., and manifested by exudations of gum and a general unhealthy condition of the trees, are quite common in California. Bulletin 200 of the California Agricultural Experiment Station treats this subject fully.

Scaly bark, a disease somewhat similar in character, has been quite destructive in some sections of Florida. This is described in Bulletin 98 of the Florida Agricultural Experiment Station.

CEREALS.[a]

RUSTS.—Every year cereal rusts are prevalent. The stem-rust and leaf-rust of both wheat and oats cause the greatest damage. In parts of the South Atlantic and Gulf States oat growing for grain is practically prohibited, while more or less damage is caused by oat rust annually throughout the Mississippi Valley region and the North Central States. The Middle Northwest suffered very appreciably from these diseases in 1908. The rusts of wheat, though perhaps less abundant than the rusts of oats, except in epidemical years, annually cause large losses on account of the economic importance of the crop which they attack. This is true even in a season not known as a "rust year." In 1908 in localities in the Middle Northwest the wheat crop was very materially reduced by stem-rust. Barley and rye, because of their early maturity, suffer less from rusts than oats and wheat. In 1908, however, stem-rust of rye was very common in Minnesota, and stem-rust of barley was not at all rare.

Special attention is being paid to the breeding of rust-resistant cereals at various experiment stations and the results for 1908 at the Minnesota, North Dakota, and some other stations were very promising.

SMUTS.—From the standpoint of treatments for prevention, smuts of the small-grain crops can be divided into two classes: (1) Those such as stinking smut of wheat, covered smut of barley, smuts of oats, kernel-smut of sorghums, and one millet smut (*Ustilago crameri* Körn), which can be prevented by treating the seed with formaldehyde, copper sulphate, hot water, or some other disinfectant. (2) Those which do not respond to the ordinary treatments, including the loose-smuts of wheat and barley, head-smut of sorghums, and corn smut.

Stinking smut of wheat is especially prevalent in the far western wheat-growing States and in parts of the Mississippi Valley and Great Plains and is well scattered all through the wheat-growing region. An estimated annual loss of 2 per cent of the total wheat crop, or about $10,000,000 annually, is caused by this disease alone. Intelligent seed treatment (as described in Farmers' Bulletin 250 of this Department) will prevent this smut. Smuts of oats, conservatively estimated, cause an annual loss of at least 3 per cent of the total oat crop of the United States. These smuts also are easily prevented by seed treatments. The covered smut of barley is well scattered in barley-growing regions. Estimates of 5 per cent of covered smut were made in barley fields in Oklahoma in 1908 and 3 and 4 per cent in Minnesota. It was common in Nebraska and other States in the Great Plains area. High percentages were reported from fields in California. This disease also is easily prevented by steeping treatments. Kernel-smut of sorghum is conservatively estimated as causing a damage of one-half per cent of the total sorghum grain crop in 1908. It was conclusively shown by the Department of Agriculture in 1907 and 1908 that this smut is easily prevented by formalin or hot-water treatments. (See Circular 8, Bureau of Plant Industry, The Smuts of Sorghum.)

The loose-smut of wheat in 1908 caused an estimated loss of at least one-half per cent of the total wheat crop of the United States, and the loose-smut of barley 2 per cent of the total barley crop. Western New York reported as high as 8 per cent loss from loose-smut in some wheat fields, and Minnesota 3 to 4 per cent. The smut was common in Nebraska, Kansas, and other States in the Great Plains region. In States in the Middle Northwest, 4 and 5 per cent of loose-smut in barley was not uncommon.

In 1907 and 1908 the intraseminal infection of these smuts in the United States was demonstrated by the Department of Agriculture and methods of preventive treatment were improved and elaborated. These consist in soaking the seed for five to seven hours in water at a temperature of about 68° F. (20° C.) and then treating for ten minutes with hot water at 129° F. (54° C.) for wheat, and fifteen minutes with water at 126° F. (52° C.) for barley. The treatment is recommended in connection with a seed-plat system. (See Bulletin 152, Bureau of Plant Industry, The Loose Smuts of Barley and Wheat.)

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[a] Prepared by Mr. E. C. Johnson.

The head-smut of sorghums is beginning to be prevalent in parts of Texas and Oklahoma, as high as 12 per cent having been reported in some fields in Texas in 1908. It promises to be a serious disease unless checked. No sure preventive is yet known.

Corn smut was common in corn-growing States in 1908. No check is yet known.

ERGOT.—Ergot of rye is apparently on the increase in many rye-growing regions, notably in the Middle Northwest. Barley is also affected to some extent, but thus far the loss has been very small. No sure preventive of ergot is yet known.

SCAB.—Wheat scab (*Fusarium culmorum* (W. G. Sm.) Sacc.) in 1908 was prevalent in Ohio, Indiana, Minnesota, parts of the Dakotas and Nebraska, as well as in some of the Eastern States. It seems to be developing in serious proportions, but as yet there are no known means by which it may be effectively checked.

ANTHRACNOSE.—Anthracnose of rye (*Colletotrichum cereale* n. sp.), a new disease causing premature ripening and shriveling of the kernels, is described and reported by Selby and Mann, in Bulletin 203 of the Ohio Agricultural Experiment Station, as prevalent in that State. Anthracnose also affects oats, wheat, barley, and emmer, being parasitic on roots, culms, and leaves.

POWDERY MILDEW.—Powdery mildew of wheat and barley was prevalent in 1908 in Virginia, West Virginia, Delaware, Maryland, and parts of Pennsylvania. It is also reported from some adjoining States.

MISCELLANEOUS.—"Spikelet blight of oats" (cause unknown), resulting in numerous unfilled spikelets in the oat panicle, was prevalent in fields in Minnesota. Yellow-leaf disease (*Helminthosporium gramineum* Rabh.) was reported on barley in Nebraska, Iowa, and Minnesota.

RICE DISEASES.—Troubles affecting rice have not been unusually prevalent this year. In Bulletin 105 of the Louisiana Experiment Station, Prof. H. R. Fulton summarizes the results of his work on rice diseases, describing rice blast and verifying the discoveries of Doctor Metcalf. (See Bulletin 121 of the South Carolina Agricultural Experiment Station.) He describes a brown spot of rice grains, due to fungi and bacteria following insect punctures. Two smuts, green-smut and black-smut, are discussed. Both occur in Louisiana, but have not yet become serious.

FOREST AND SHADE TREES.[a]

The following diseases have been the most serious during the current year:

The chestnut bark disease (*Diaporthe parasitica* Murr.) has now destroyed practically all the chestnut trees in New York City and Staten Island, and in Nassau, Westchester, Putnam, and Rockland counties, N. Y.; Fairfield County, Conn.; and Bergen, Passaic, Essex, Hudson, Union, Middlesex, and Monmouth counties, N. J. New centers of infection have been located in Bedford County, Va.; Kent and New Castle counties, Del.; Baltimore County, Md.; Lancaster and Northumberland counties, Pa.; New London County, Conn., and at many intermediate points. Nothing but general and vigorous quarantine methods will now keep the disease from completely destroying the chestnut timber of the country.

The white-pine blight prevalent in eastern New York and New England during 1907 and 1908 has been found not to be a single disease. In 1907 a leaf-blight was the most prevalent trouble, while in 1908 various twig-blights were most prevalent in many localities. These twig-blights were caused by different factors in different localities; in Maine, winterkilling was responsible for much of the trouble, while another form of the disease was caused by fungi; in New Hampshire, and to a less extent in Maine, another form of blight was associated with insects, and is being studied by the Bureau of Entomology. The primary cause of the leaf-blight is yet unknown. The cutting of the unaffected pine trees from fear of the blight is utter folly with our present understanding of the disease. Such procedure is emphatically condemned, as it has been found that half the trees attacked by leaf-blight are recovering, and the twig-blights are of such a character that they are not likely soon to recur destructively.

The damping-off of forest-tree seedlings continues to be prevalent in all nurseries. The recent great increase in the production from the nurseries of the country makes it imperative that some practical method of combating the trouble be devised. The investigations to date are very encouraging, and indicate that the sulphuric acid

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[a] Prepared by Dr. Haven Metcalf.

treatment will soon be well enough understood so that it may be safely recommended to nurserymen. (See Circular 4, Bureau of Plant Industry.)

The fungus (*Trametes pini* (Brot) Fr.) which causes the very destructive heart-rot of nearly all coniferous species is very prevalent throughout the coniferous forests of North America. It usually occurs locally, and in certain infested areas it may cause the almost complete destruction of otherwise valuable timber. Investigations in the past year have shown it to be especially prevalent in the relatively mature forests of the Rocky Mountain and Pacific coast regions.

The past extremely dry summer was very favorable for certain fungi which attack the leaves of trees. The mildews (Erysiphaceæ) were very common on the leaves of many of the forest trees throughout the Northern States from New England to central Minnesota, and the same was true of the rusts (*Melampsora* spp.) affecting the various species of willows and poplar. Whether the weather affected the prevalence of the rusts (*Peridermium* spp. and *Gymnosporangium* spp.) occurring on the conifers is questionable, but many of these were noted in all parts of the country.

THE PROGRESS IN FORESTRY IN 1908.[a]

By TREADWELL CLEVELAND, Jr., *Forest Service.*

More thorough knowledge of actual forest conditions has brought a wide realization of the importance of the forest in the life of the Nation. Enough is now known to make imperative a complete change in the methods of forest use, and the ways in which this change may best be brought about are discussed with equal interest by the specialist and the man in the street. National welfare, as well as individual comfort, is seen to be dependent upon forest conservation. To this better knowledge and surer insight is mainly due the progress which forestry has made in the past year.

Unprecedented forest fires served a similar purpose, so that the lesson which they taught, in spite of its terrific cost, will probably pay for itself. With a unanimity never before paralleled the people of the country are demanding that a stop be put to forest waste and destruction.

The more striking lines of advancement in forestry in 1908 were the following:

(1) Through appropriate educational channels, public interest in forest problems was secured more directly and effectively than ever before. Especially valuable was the work begun in the schools, from the primary grades to the colleges. The press aided materially in making clear the need and purpose of forest conservation.

(2) The management of the National Forests was more scientific, and at the same time more satisfactory from a business point of view and more useful to the public, than ever before.

(3) The States displayed a keener interest and a livelier activity in forest matters, and State legislatures either passed or considered bills in which advanced provisions were made for forest protection from fire and unjust taxation and for regulating the use of private forest property in the interest of the public welfare.

(4) A partial census taken among private forest owners furnished proof that the practice of private forestry is extending more rapidly than was supposed, particularly among those who in their businesses are themselves users of forest products.

ADVANCE IN FOREST EDUCATION.

The progress in the work of education both in the schools and among the public at large during 1908 was unprecedented, and results are most gratifying. Much work has been accomplished in both graded and high schools. Some phases of elementary forestry are now being taught in hundreds of these schools, and in some States whole counties have introduced the subject as a permanent feature of the school curriculum. Among these Iowa is conspicuous. In Washington, D. C., all the public schools have introduced a study of the forest into their nature-study courses for the fifth, sixth, seventh, and eighth grades. Four of the Washington schools are using forestry in all their classes and are working out, in cooperation with the Forest Service, the most practical method of utilizing in the graded schools the material which forestry furnishes. In Philadelphia a similar work is being done for secondary schools in one of the public high schools there. Outlines of the nature-study courses worked out in the District of Columbia will later be available for public distribution.

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[a] With addenda to June 1, 1909.

The subject of forestry has been taught in the Normal School of the District of Columbia for three or four years, so that when the student-teachers take up the actual work of teaching forestry they are already quite familiar with the forest and its ways.

Educational periodicals have shown an increasing interest in forest preservation. The demand for public addresses on forestry and related subjects has been surprisingly large. The growth manifested in every phase of education in forestry has been especially evident in the increase in the number of copies of publications issued by the Forest Service—1,637,457 in 1907, and 3,313,470 in 1908.

National Forest Administration.

ADMINISTRATIVE CHANGES.

Six district headquarters in the field, located at Missoula, Mont., Denver, Colo., Albuquerque, N. Mex., Ogden, Utah, San Francisco, Cal., and Portland, Oreg., were established by the Forest Service December 1, 1908. This step brought the Service into more immediate touch with the public and went far toward carrying out the policy of having the Forests administered as far as possible by men actually on the ground. The investigative work of the Service is still chiefly centered at Washington, but such of it as mainly concerns the districts is handled at the district offices.

Each of the district offices has a district forester and an assistant in charge, and under them are experts in charge of the various lines of work.

The working of this administrative change is all that was anticipated. Business is transacted more quickly and cheaply, payments to employees are more promptly made and received, and mutual understanding between the public and the Service is constantly increasing.

The National Forests were redistricted so as to equalize the administrative units and to arrange the Forest boundaries in such a manner as to promote the most practical and efficient administration of the Forests. As far as possible the administrative units were reduced to not more than 1,000,000 acres in area. The Forests were at the same time renamed so as to perpetuate the names of men and events prominently connected with the history and development of the western country. The Forests now number 146.

ADDITIONS TO THE NATIONAL FOREST AREA IN 1908.

During the year the area of the National Forests was increased by the creation of three new Forests—two in Florida and one in North Dakota. The Ocala Forest, in Florida, created November 24, 1908, and comprising 201,285 acres, is the first National Forest east of the Mississippi. On November 27 was created the second of the Florida Forests, the Choctawhatchee, which comprises 467,606 acres. The Dakota Forest, created November 24, is the first in North Dakota.

Since January 1, 1909, the National Forest area has been increased (to May 17, 1909) by 25,819,004 acres, consisting in part of additions to existing Forests and in part of the following new Forests:

New National Forests.

Name.	Location.	Date of creation.	Area in acres.
Marquette	Michigan	Feb. 10, 1909	30,603
Nevada	Nevada	do	1,222,312
Michigan	Michigan	Feb. 11, 1909	132,770
Superior	Minnesota	Feb. 13, 1909	909,734
Zuni	Arizona and New Mexico	Mar. 2, 1909	670,981
Total			2,966,400

The present total area of the National Forests (June 1, 1909) is 194,500,043 acres.

INCREASE IN USE OF NATIONAL FORESTS BY THE PUBLIC.

The increase in the kinds and amount of business done on the National Forests since 1891 is shown in the following table:

Kind and number of permits and number of timber sales, fiscal years 1891–1908 inclusive.

Year issued.	Special use.	Grazing.	Crossing forest with stock.	Free timber.	Total permits.	Timber sales.
Fiscal years 1891 to 1898 inclusive						
Fiscal year 1899						6
Fiscal year 1900						12
Fiscal year 1901		2,317		283	2,600	31
Fiscal year 1902		3,126		1,289	4,415	77
Fiscal year 1903		4,554	8	2,135	6,697	156
Fiscal year 1904		6,733	277	3,239	10,249	377
Fiscal year 1905	298	7,981	346	3,363	11,988	411
Fiscal year 1906	604	16,593	503	8,097	25,797	1,023
Fiscal year 1907	1,880	21,788	1,449	17,399	42,516	1,508
Fiscal year 1908	3,141	24,127	1,161	30,377	58,806	5,062
Total	5,923	87,219	3,744	66,182	163,068	8,663

NOTES.—Canal, ditch, flume, pipe-line, and other water transmission permits included with those for conduits.

Special-use pasture permits not included under "Grazing."

Two hundred and twenty-three special-use permits issued prior to February 1, 1905, included in number reported for fiscal year 1905.

A remarkable growth in business in the last fiscal year (1908) is evident. While in that year the money available increased only 20 per cent and the area of Forests administered increased only 11 per cent, the business done increased in the following percentages:

	Per cent.
Timber sales	236
Timber cut	102
Number of free-use permits	76
Number of special-use permits	67
Sales and fees received	20
Number of grazing permits	11
Total number of sales and permits	46

Timber to the amount of 386,341,300 board feet was sold in 5,062 separate sales. The policy of the Service is to favor small purchasers as far as possible, and it is noteworthy that of these sales 4,584 were made for timber valued at $100 or less. Since the disposal of timber on National Forests began, the total cut down to the close of the last fiscal year (June 30, 1908) is 1,947,101,717 board feet.

FIRE PROTECTION AND LOSS.

The year 1908 will long be remembered for its enormous losses by forest fires. A dry season, combined with what seemed to be even more than the usual indifference toward small fires which might easily have been extinguished at the start, caused destructive conflagrations in practically every State, with losses aggregating $100,000,000. In comparison with the havoc wrought elsewhere, the damage done to National Forests was exceedingly slight. Had fires raged within the Forests as they did outside, they would have destroyed timber worth $30,000,000—enough to run the Forest Service for ten years. Moreover, it is practically certain that most if not all of the damage which was done might have been prevented had the Forests been fully manned. Finally, the estimates of loss made by the Service on National Forests are particularly searching, and take full account of the injury done to young growth. Commonly, estimates of loss from forest fires are based upon the damage done to standing timber and to property; they do not reckon the usually far greater loss in injury or destruction of young growing stock.

The following table shows the losses by fire on National Forests from 1905 to 1908, inclusive:

Fire losses on National Forests.

	1905.	1906.	1907.	1908.
Area of National Forests..........................acres..	97,711,455	127,167,271	162,023,190	....
Area of forest burned over.........................do....	279,592	115,416	109,410	414,638
Amount of timber burned........thousand board feet..	152,557	101,970	31,026	232,191
Value of timber burned..................................	$101,282	$76,183	$31,590	$451,188

The methods by which the Service keeps down the fire losses on the Forests include: (1) Constant patrol by a picked force of rangers and guards; (2) the construction of roads and trails, which facilitate the massing of large fire-fighting forces and also serve as fire lines, and of telephone lines connecting ranger stations with Forest headquarters; (3) the equipment of the Forests with fire-fighting tools, canteens, and other supplies necessary in fighting fires. The cooperation of settlers and users of the Forests proves of the greatest value.

PROGRESS IN SILVICULTURE.

The chief problem which the Service has to solve in the management of the Forests is that of finding and applying silvicultural methods which will at once facilitate the use of the timber and insure its perpetuation. The Forests compose at least four main groups, each of which requires special treatment; technical men are scarce, and the cost of logging often forces the Service to meet the alternative of letting timber go to waste or disposing of it at some sacrifice to the permanent welfare of the Forest.

In the beginning the utmost that could be done toward right silvicultural practice was to make provision in the timber-sale contracts for a diameter limit, the leaving of seed trees, the disposal of brush, low stumps, precautions against injury to young growth, and, in some instances, the utilization of inferior species. Gradually, as experience was gained, silvicultural knowledge increased, and more technical men were available, it became possible to adapt such provisions more closely to the distinct forest types.

The Service prepared during the year a separate set of marking rules for each of the silvicultural regions in which the National Forests are located, so as to secure in each case results suited to local forest and market conditions. The silvicultural systems now practiced on the National Forests include: Improvement cutting; a modified selection system which aims especially to dispose of the dead, over-mature, insect-infested, and fire-damaged trees and the inferior species; and clear cutting, either in strips or with the leaving of scattered seed trees or groups.

In all respects a marked advance in the silvicultural treatment of the Forests was made during the year. Work in the woods was more cleanly done, stumps were cut lower, and the brush was more satisfactorily disposed of. Another gain was secured by finding better markets for a number of Forest timbers, among which were white fir, hemlock, aspen, fire-killed lodgepole pine, and cedar.

PROGRESS IN RANGE CONTROL AND IMPROVEMENT.

The year 1908 was a very satisfactory one to the stockmen using the National Forests. In spite of a rather backward season, the growth of grass and forage all over the ranges was excellent. Stock entered nearly all of the Forests in rather poor condition, but in the fall, from every Forest, came the report of fat steers and lambs, and the various classes of stock left the Forests in better condition than for many years past. The owners in most cases ascribed the gains to improved methods of handling the grazing lands, which resulted in more feed, less harassing of the stock by round-ups, fewer controversies over the range, and the prevention of overcrowding.

During the year 20,000 permits were issued for grazing cattle and horses on the Forests, which covered 1,304,000 head of cattle and 76,000 horses; and 4,000 permits were issued which covered 6,960,000 sheep and 120,000 goats. Of the permits issued for cattle and horses, 12,600 were for less than 40 head, a fact which shows that to a very great extent the users of the Forests are the small men, the home builders

A large amount of money was spent for improvements that would help toward handling stock more cheaply and easily, and with less injury to the ranges. Many bridges were built by means of which stock, especially sheep, may be moved from one part of the range to another by the shortest routes. Trails have been made so that hitherto inaccessible ranges which were never before used by the sheepmen have been brought into use. Almost a thousand miles of drift fences were built, with a saving to the cattlemen of many thousands of dollars in handling their herds and in reduced losses from straying and stealing.

Careful experiments are being conducted in the Wallowa Forest in eastern Oregon, in cooperation with the Bureau of Plant Industry, regarding the possibilities of reseeding and restoring the overgrazed areas where the original grasses seem to have been almost completely killed out. Results already indicate the entire possibility of restoring these overgrazed areas to much of their original value through a systematic course of careful grazing which will allow the forage plants to do their own reseeding.

In the effort to reduce the loss due to the herding system an experiment was made with a sheep pasture similar to the pastures used by sheep growers in the Middle West. A coyote-proof pasture, containing 2,460 acres of mountain land, was fenced in the Imnaha Forest to learn whether sheep could be ranged loose without a herder and how much more stock the area would carry when so used. This fence turned all wild animals except grizzly bear, which managed to break through three or four times. Few sheep were lost in the pasture. The inclosed area supported a much larger number of animals than it would have done under herding, while the condition of the sheep was better than usual at the end of the season. (See Pl. LIII.)

Certain areas of the National Forest range have remained undeveloped on account of lack of facilities for watering stock. By making water available, and so saving the stock long journeys to and from watering places, the Service has greatly increased the carrying capacity of the range.

Probably no work undertaken during the year proved more satisfactory and valuable to the stock interests than did the destruction of prairie dogs which infested the ranges within many of the National Forests. This work was done in cooperation with the Biological Survey. The stockmen have requested its extension.

A constant war was waged upon the predatory animals which annually cause immense losses to the stock interests, and wherever the results appeared to justify the expense hunters have been employed, with signal success, to trap or otherwise destroy them.

During the year there was a very great improvement in the attitude taken toward the Service by the stockmen of the West. This was brought about by improved service rendered, a better understanding of the regulations and provisions for handling the grazing business by both the Forest officers and the users of the Forests, and the attendance of responsible officials at the meetings of the users, especially the meetings of the numerous live stock associations.

PERMANENT IMPROVEMENTS.

The development of the regions in which Forests are located is greatly stimulated by the permanent improvements which during the past two fiscal years have received special appropriations from Congress. Roads, trails, and bridges for readier travel and transportation and the protection of the Forests; telephone lines—one of the greatest aids in reporting fires and getting together a fire-fighting crew, as well as in the transaction of ordinary forest business; drift and pasture fences for the control of stock and watering places for their use; houses, barns, and corrals for various purposes, are transforming the Forests and insuring the safety and convenience of settlers and users. (See Pl. LIV.)

The following table shows by States the kind and amount of permanent improvement work done in 1908 for the purpose of developing the resources of the National Forests and increasing the means of transportation and communication within them:

Permanent improvement work on National Forests, 1908.

State.	Trails.	Roads.	Telephone lines.	Fences.		Cabins.	Barns.	Corrals.	Bridges.	Watering places.	Amount expended.
				Drift.	Pasture.						
	Miles.	*Miles.*	*Miles.*	*Miles.*	*Miles.*						
Arizona	30½	1½	106½	25	47	23	10	2	3	6	$27,872.95
California	543½	21¾	490	5½	49½	61	28	......	14	4	85,910.48
Colorado	266¼	42½	517	57¾	93¾	49	17	1	7	7	65,700.86
Idaho	582½	120	193½	1	21¾	37	10	5	16	1	78,402.48
Montana	422½	45½	436	2	51½	53	32	......	7	......	94,750.72
Nebraska	......	......	92	......	2	1	1	......	......	......	2,985.54
Nevada	......	......	......	1½	2½	5	2	......	......	......	3,748.13
New Mexico	236¾	52¾	41	58½	61¾	28	8	1	1	1	31,463.51
Oklahoma	......	......	......	2	1	1	1	......	......	......	1,462.00
Oregon	437	24	78	......	39	23	2	2	4	......	55,191.33
South Dakota	......	......	......	......	7¼	5	4	......	......	......	......
Utah	107¼	34½	365½	11½	17	24	4	......	6	27	31,542.66
Washington	311¾	17	102	5½	28	22	6	......	4	......	44,022.34
Wyoming	32½	4	194½	1½	15½	16	6	3	4	......	15,945.48
Total	2,970	363½	2,523¾	171¾	437½	348	131	14	66	46	[a] 544,435.00

[a] Equipment on hand in the supply depot, Ogden, Utah, brings this total up to $551,938.

FOREST EXPERIMENT STATIONS.

During the year was started the first of the forest experiment stations which the Service plans to establish on a number of National Forests, for the investigation, chiefly, of silvicultural problems. This station is on the Coconino Forest, in Arizona. The forest experiment stations are expected to do for the development of American forests what the agricultural experiment stations are doing for the improvement of American farms. The work to be done will be thoroughly scientific and at the same time eminently practical.

THE MUIR WOODS.

One of the most public-spirited gifts ever made to the Government came during the year from Mr. William Kent, of Chicago, who has deeded to the United States 295 acres of primeval redwood forest on the southern slope of Mount Tamalpais, about 6 miles from the city of San Francisco. This grove is one of few remaining tracts of redwood forest to be found in its natural state in California. At the request of Mr. Kent it will be called the Muir Woods, in honor of John Muir, the noted naturalist. The destruction of redwood by lumbering has been very rapid during the last decade. The large timber in the Muir Woods has escaped the ax, partly because of its location and partly because the former owners of the tract have protected it. Now that the gift has been accepted by the Government under authority of the law which provides that objects of scientific interest may be declared National monuments, the woods will be perpetuated. No other redwood tract in the State of California is so easily accessible to so many people. Its great educational value, together with the fact that it is a pleasure ground for all those who live in or visit this part of California, makes the woods an ideal National monument.

THE CALAVERAS BIG TREE GROVE.

By an act of Congress passed February 18, 1909, a way was found to save for all time one of the most famous groves of trees in the world, the Calaveras Big Tree Grove of California. For more than nine years the people of California, particularly the 500 women of the California Club, have been working to interest the Government in protecting the big trees from destruction. The act finally passed by Congress provides for the acquisition of the grove by an exchange which will give its former owner stumpage or other forest lands owned by the Government in place of the timber in the grove. No appropriation is needed to carry out the act.

The land to be acquired under the act includes 4,000 acres, of which 960 acres, known as the North Grove, are in Calaveras County, and 3,040 acres, known as the South Grove, are in Tuolumne County. There are 1,380 big trees in the grove, not counting specimens less than 6 feet in diameter. Besides the big trees, whose scientific name is *Sequoia washingtoniana*, there are hundreds of sugar and yellow pines, ranging to the height of 275 feet, and often having a diameter of 8 or 10 feet, as well as many white firs and incense cedars.

In the North Grove there are 10 trees each of which is over 25 feet in diameter, and more than 70 from 15 to 25 feet in diameter. (See Pl. LV.)

THE NEW SERVICE LABORATORY.

A very important recent event was the arrangement by which the laboratory work of the Service in the East will be brought together in one place. As a result, the Government will have at its disposal one of the best equipped laboratories for timber testing and wood chemistry in the world. The laboratory work which has been carried on with excellent results at Purdue and Yale universities and in Washington, D. C., will be continued under yet more favorable conditions at the University of Wisconsin, which will erect on its campus a laboratory building and will furnish light, heat, and power. The Service will provide the technical force, the equipment, material used in experiments, and certain courses of lectures. University students will also do advanced work at the laboratory.

State Forestry.

STATE FOREST RESERVES.

State forest reserves now cover an area of 3,281,721 acres, of which 2,837,605 acres are in continental United States and the remainder in the Territory of Hawaii. Their location and area are given in the following table:

Area and location of state forests.

State.	Name and location.	Area.	Total area.
Connecticut	1. Portland tract, Middlesex County	1,060	
	2. Union tract, Tolland County	300	
			1,360
Hawaii	Halelea, Kauai	37,500	
	Kealia, Kauai	9,935	
	Na Pali-Kona, Kauai	60,540	
	Kapaipau, Oahu	913	
	Ewa, Oahu	28,550	
	Waianae-kai, Oahu	3,257	
	Lualualei, Oahu	3,743	
	Koolau, Maui	42,969	
	Haua, Maui	14,825	
	West Maui, Maui	44,440	
	Makawao, Maui	1,796	
	Hamakua Pali, Hawaii	18,990	
	Hilo, Hawaii	110,000	
	Honuaula, Hawaii	665	
	Kau, Hawaii	65,850	
	Waiaha Spring, Hawaii	193	
			[a] 444,116
Indiana	State reservation, Clark County		2,000
Maryland	1. State reserve, Garrett County	3,500	
	2. State reserve, Baltimore County	40	
			3,540
Massachusetts	Scattered		1,000
Michigan	State reserve, Roscommon and Crawford counties		39,000
Minnesota	1. Burntside Forest, St. Louis County	20,000	
	2. Pillsbury tract, Cass County	1,000	
	3. Itasca State Park, Clearwater, Becker, and Hubbard counties	22,297	
			43,297
New Hampshire	Gift of Miss Frances A. L. Haven, Jaffrey		60
New Jersey	1. Mays Landing tract, Atlantic County	378	
	2. Bass River tract, Burlington County	2,593	
	3. Blairstown tract, Warren County	555	
	4. Kittatinny Mountain Reserve	5,432	
			8,958
New York	1. Adirondack Preserve, Clinton, Essex, Franklin, Fulton, Hamilton, Herkimer, Lewis, Oneida, St. Lawrence, Saratoga, Warren, and Washington counties	1,500,626	
	2. Catskill Preserve, Delaware, Green, Sullivan, and Ulster counties	111,191	
			1,611,817
Pennsylvania	State reserves, Adams, Bedford, Cameron, Center, Clearfield, Clinton, Cumberland, Dauphin, Elk, Franklin, Fulton, Huntingdon, Juniata, Lackawanna, Lycoming, Mifflin, Monroe, Pike, Potter, Snyder, Tioga, Union, and Wyoming counties		863,000
Wisconsin	Forest reserves, Ashland, Bayfield, Burnett, Douglas, Florence, Forest, Iron, Langlade, Lincoln, Marinette, Oneida, Polk, Price, Rusk, Sawyer, Vilas, and Washburn counties		253,573
	Grand total		3,281,721

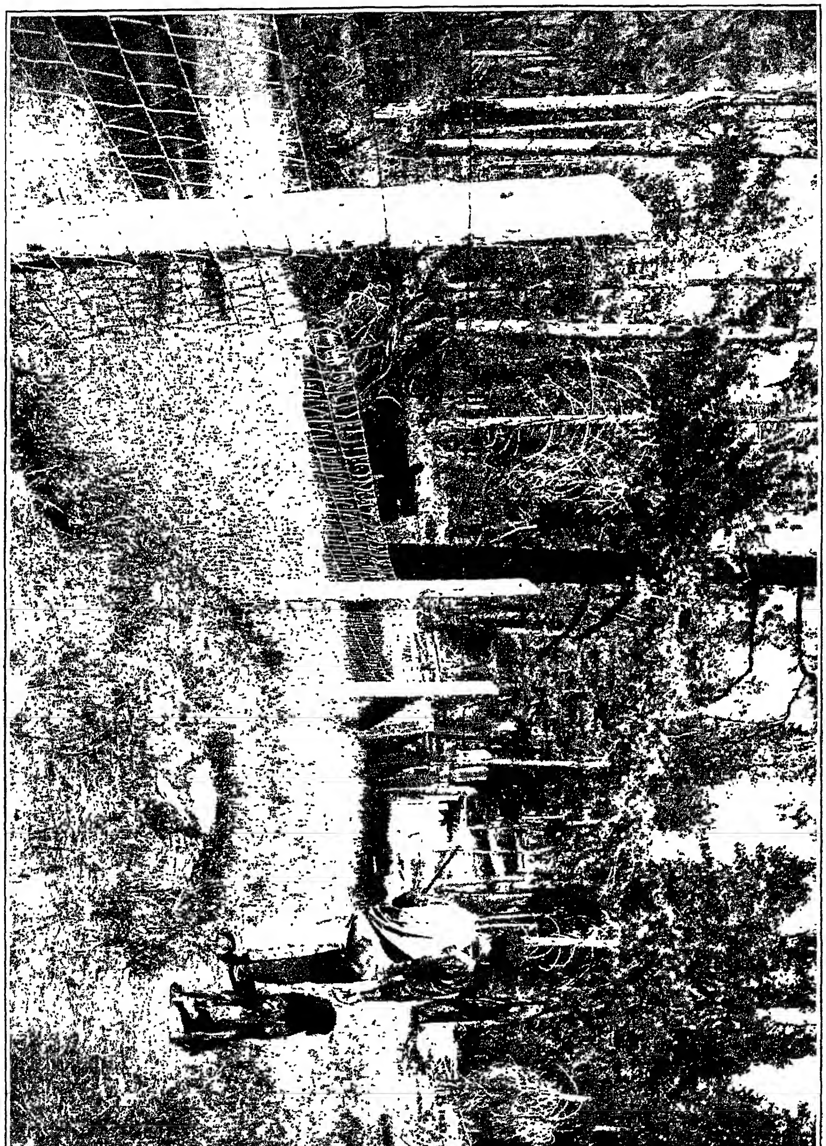
[a] Of this total 61 per cent is Government land.

Cooperation Between the States and the Forest Service.

Following the conservation conference in May, 1908, the Forester invited the States to cooperate with the Service in studying the problem of forest conservation. As a result of this invitation the work done by the Service in cooperation with the States was more important than in any previous year.

In *New Hampshire* a careful study was made of the actual working of the tax laws, with special reference to forests, and the Service recommended changes in forest taxation which would encourage the holding of forest lands for timber production.

In *Kentucky* the study of forest conditions, begun in the previous year, was pushed forward; more than half the State has now been covered.



A COYOTE-PROOF PASTURE FENCE IN THE IMNAHA NATIONAL FOREST, OREGON, CONSTRUCTED TO TEST THE FEASIBILITY AND ECONOMY OF GRAZING SHEEP WITHOUT A HERDER.

[A ranger is patrolling the fence, on the lookout for breaks and predatory animals.]

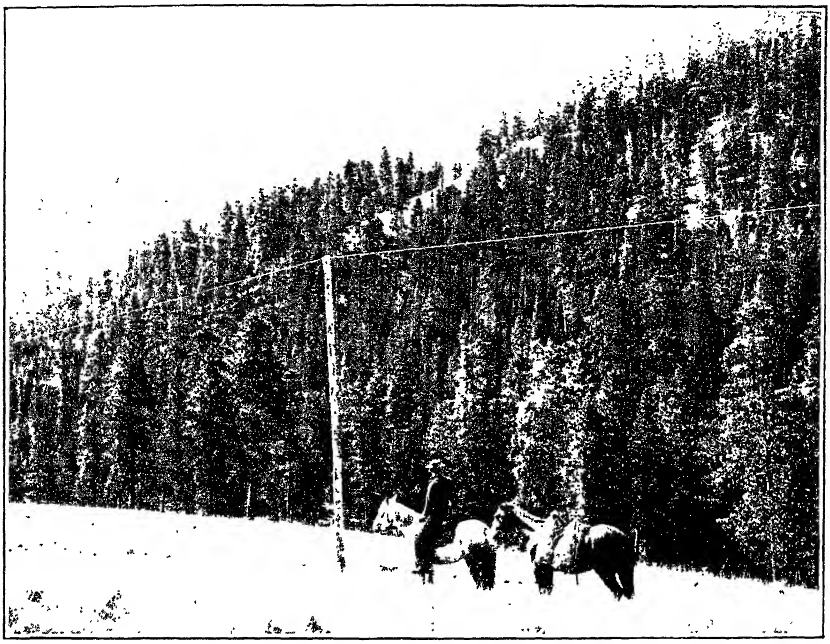


FIG. 1.—A TELEPHONE LINE IN THE WALLOWA NATIONAL FOREST, OREGON.

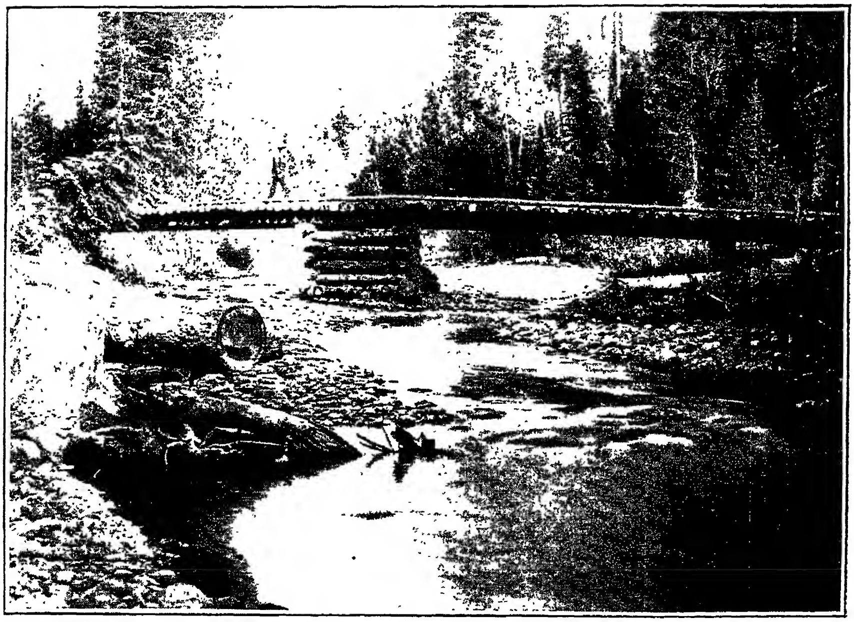
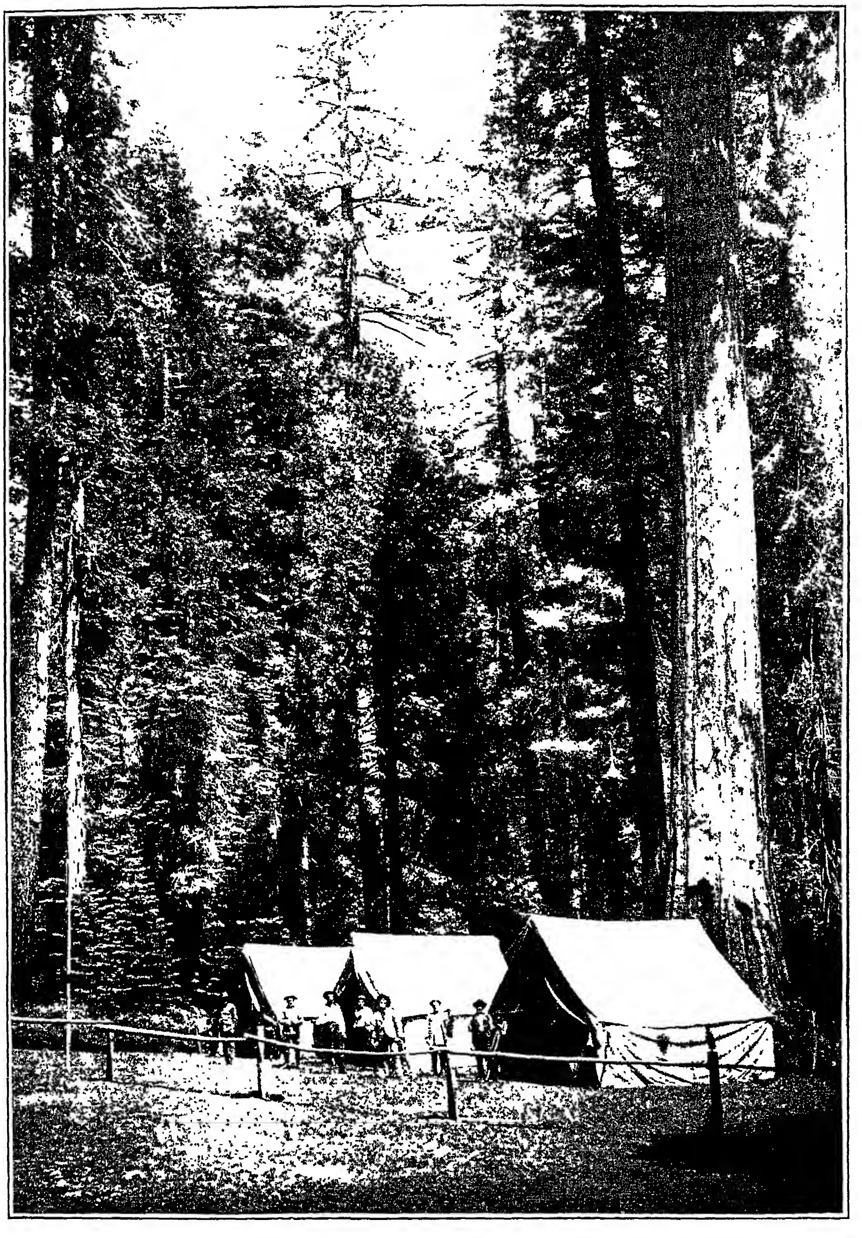


FIG. 2.—A BRIDGE IN THE WALLOWA NATIONAL FOREST, OREGON.



THE CALAVERAS BIGTREE GROVE, IN CALIFORNIA. A FOREST SERVICE CAMP IN THE FOREGROUND.

[This grove is to be acquired by the Government as a National Forest by means of an exchange of stumpage on other Government lands for stumpage in the grove.]

At the request of *Vermont* the Service prepared the draft of a State forest law, providing for a State forester and an ample appropriation for carrying out the purposes of the law. An act was passed embodying substantially the recommendations of the Service, and a State forester has been appointed.

In *Michigan* a bill amending the State fire law was introduced in the legislature, and a proposed bill for the better taxation of timber lands was framed in cooperation with the Forest Service. The Service also advocated a provision in the former bill which provides for the withdrawal of tax lands for State forest reserve purposes.

In *Alabama* the Service has made a preliminary study of forest conditions, the chief result of which will take the form of recommendations for the improvement of the forest law passed at the last session of the legislature. The State legislature meets again in 1911.

At the request of *Florida* the Service recommended a forest law for that State which will provide for a forest commission and, if possible, also for a State forester.

In *Illinois* a preliminary study of forest conditions in typical regions was begun in cooperation with the Service.

COOPERATIVE AND EDUCATIONAL WORK WITHIN STATES.

A marked extension of cooperative and educational work within the States took place during the year. This assumed the form of advice and demonstration for the management of timber lands and woodlots; cooperative agreements for fire protection; the distribution of forest-tree seedlings, frequently with directions for starting and caring for plantations; increase of attendance at forest schools; courses of lectures at educational institutions, the distribution of educational literature, and general instruction by means of addresses delivered both at such institutions and before interested bodies of citizens.

In *Connecticut* about 600,000 trees were planted by private owners, and the number of land owners practicing forestry in the State was more than doubled during the year.

In *Indiana* about 400 acres of land in the State reserve have been planted, and improvement cuttings have been made on about 300 acres.

In *Maine* the enrollment of forest students in the State University is now three times what it was in 1906; 46 students took forestry for their major subject in the college year 1907–8.

In *Maryland* the lectures at the State Agricultural College and at the State Farmers' Institute and addresses before various organizations were continued, and the educational work was extended through a successful press campaign.

In *Massachusetts* the State now owns 1,000 acres, 840 acres of which were deeded to the State for forest purposes. In most cases the owners availed themselves of the clause in the new law which enables them to repurchase the lands within ten years at the price originally paid by the State, together with the amount expended in improvements and maintenance, with interest at 4 per cent on the purchase price. Examinations of 64 woodlots, embracing 15,842 acres, were made; four of these included working plans. The most important of the working plans was one for the city of Fall River, and covered the watershed of North Watuppa Pond, from which the city's water supply is drawn, an area of more than 5,000 acres. Orders for 115,000 white pine seedlings and 26,183 ash seedlings were filled from the Amherst Nursery, and 40¾ pounds of white pine seeds were sold. Additional orders for 235,000 seedlings were filled through commercial nurseries. In the fall of 1908 nursery stock on hand numbered 1,535,100 seedlings.

In *Minnesota* a forest school under the charge of the State University is maintained in Itasca Park.

New Hampshire acquired a new reservation of some 60 acres located in Jaffrey, by the public-spirited gift of Miss Frances A. L. Haven, of New York City.

In *New Jersey* the instruction of woodland owners by advice on the ground, and more general instruction at public meetings, made good progress.

In *North Carolina*, at the tenth anniversary of the Biltmore Forest School, a forest festival was held, to which were invited many lumbermen, foresters, and other persons interested in forestry. Several days were devoted to excursions through the Biltmore forests, and the various forest operations were clearly shown by the director.

In *Ohio* nearly three-quarters of a million seedlings were distributed, chiefly catalpa and yellow locust, to persons agreeing to plant and care for them under the instruction of the forester of the experiment station and to permit inspection at all times. There are now 544 persons cooperating with the State in forest planting. During 1907 and 1908 recommendations were made for the care of 1,287 woodlots, aggregating 101,088 acres. A forest survey of the State is in progress, and it is planned to give personal

instruction to woodland owners along the route of the survey. What is felt to be most needed is actual demonstration of good forest practice.

In *Pennsylvania* the State reserves now comprise about 863,000 acres. The State employs 17 foresters and about 70 rangers. During 1908 the forest nursery area was enlarged to include in all about 25 acres, and this season the nurseries will have irrigation systems. The State Forest Academy sent three classes into the reserves for study.

In *Washington* the State board of forest commissioners made a voluntary working agreement with the Washington Forest Fire Association, which is composed of timberland owners west of the Cascade Range holding some 2,600,000 acres and raising fire protection funds by assessing themselves about 1 cent an acre. Most satisfactory results were secured.

In *Wisconsin* a course of 16 lectures on forestry was given at the State University to 184 students. The State forester recommends a ranger school along the lines of that of Pennsylvania, for the training of men for positions as forest rangers, foremen in charge of lumbering operations, and expert cruisers.

Private Forestry.

THE LESSON OF THE FIRE LOSSES.

The tremendous losses by forest fires in 1908 gripped the attention of the country and roused forest owners to fresh efforts to protect their property. Though the damage done was incalculable and marked the year as the most disastrous in this respect in the history of the United States, a powerful stimulus was given to forest conservation, so punishing was the havoc wrought by the flames. Legislation and urgent recommendations for legislative action are one result of this costly lesson; a change in public opinion from indifference to active interest is another; marked advance in private protective action is a third. In Idaho and Washington many of the larger timberland owners have formed themselves into fire-protective associations, raised a fund by assessing their holdings so much per acre, and devoted the sum so raised to fire fighting—above all, to patrol. The States and the National Government cooperated with these associations with excellent results. These and similar efforts elsewhere have now established the fact that forest fires can be practically prevented by patrol systems costing from 2 to 4 cents per acre, according to the character and location of the forest and the resultant fire risk. Indeed, the supreme importance of complete patrol has been demonstrated as never before. To secure efficient patrol is recognized by foresters everywhere as the first and most decisive step to be taken toward protecting forests from fire.

COOPERATION OF PRIVATE OWNERS WITH THE FOREST SERVICE.

During the year the service made examinations of 39 private forest tracts, located in 17 States, ranging in size from 10 to 365,000 acres and aggregating 498,557 acres. In these cases recommendations were made for conservative management.

One of the most interesting cooperative projects was with a railroad and mining company in Alabama. This company owns about 170,000 acres of forest, from which it cuts about 21,000,000 feet a year. The forest consists mainly of longleaf pine, but loblolly pine and mixed hardwoods make up a less important part of the stand. The aid of the Forest Service was sought in order to secure a definite plan by which the annual cut could be harvested and used with the greatest economy and the best advantage to the forest. There is a permanent demand for cross-ties and mine timbers. The company wants to grow the timber to supply its own needs, and no more than the annual yield will be harvested. At present 40 per cent of the timbers used in the mines is destroyed by decay. Hereafter this 40 per cent will receive preservative treatment before being placed in the mine. Heretofore the cross-ties have been hewed, but hereafter they will be sawed, and the estimated saving from this source will be $6,000. Cleaner work is to be required in the woods. Finally, an effort is to be made to utilize the inferior kinds of woods by the use of preservative treatment. This plan, therefore, contemplates the conservative utilization of all classes of products at every step from the stump to the place of use, together with a careful system of forest management which will guarantee a permanent supply of the required products.

SILVICAL STUDIES IN BEHALF OF PRIVATE FORESTRY.

During the year the Forest Service made a number of studies for the benefit of private timberland owners. In the Central States and in part of the South a commercial tree study was made of the different species of ash to determine their rate of growth and the

best method of management to use for each. A study of cypress was made in the lower part of the Mississippi Valley and in Florida, with special reference to reproduction on overflowed lands and bottoms, and to rate of growth. A commercial study of paper birch in the Northeast, begun the year before, was finished. A study of the chestnut blight was made with a view to determining its importance, its method of spread, and possible means of prevention.

In addition to these eastern studies several studies were made in the National Forests, the results of which are of value to owners of timberland in the West.

THE STATE AND PRIVATE OWNERS.

FOREST TAXATION.—The movement for reform in forest taxation made notable progress, and the sentiment supporting it was considerably strengthened. At the second meeting of the International Tax Association, held in the autumn of 1908 at Toronto, Canada, a number of important papers were read upon the subject and were discussed by men of prominence. The principles of a scientific and just taxation of forests then laid down have since been embodied in laws proposed in the State legislatures of Maine, Michigan, New Hampshire, Oregon, and Washington. Constitutional amendments are necessary in a number of States.

MOVEMENT TOWARD STATE REGULATION.—During the year bills were introduced in the legislatures of Louisiana, Maine, New York, Oregon, Pennsylvania, and Washington providing for various degrees and kinds of restrictions by the State upon the use of private forest land. The restrictions range from the fixing of a universal diameter limit, below which no trees may be cut, to more or less complete rules of silviculture. Without going into the merits of the specific provisions of these bills it is easy to see in them a tendency toward the assertion by the State of a right to regulate the private use of forest property, at least its business use, in the interest of the general welfare. This tendency is exceedingly significant, since it indicates the gradual crystallization of the idea that ownership of this natural resource involves a responsibility to the public.

It remained for New York to take the first step in enacting this idea into positive law in a statute passed May 22, 1909, the provisions of which are described below.

GENERAL ADVANCE.

Investigations made during the year brought out the fact that forestry is being practiced more and more on private lands. Perhaps the most notable examples of the private practice of forestry are furnished by timberland owners who themselves are users of forest products. Conspicuous among these are wood pulp and paper manufacturers, mining and railroad companies, and water companies. A number of pulp manufacturers are managing their forests for a sustained yield, protecting them from fire, and, when necessary, extending them by fresh purchases. Several water companies now realize that the forest needed to protect their reservoir catchment basins may be made to yield returns in timber without injury to their protective function, and are adding to their revenues by disposing of the annual yield of wood in the form of cordwood, posts, and cross-ties. More than one railroad company has taken up forestry with a view to producing from their own holdings the cross-ties needed to maintain and extend their tracks. They are doing a good deal of forest planting and are purchasing cut-over lands in order to manage them for the production of future crops. Investments have been made in tracts stocked with the cheaper woods, such as loblolly pine, which can easily be treated with preservatives and made to do good service.

THE CONSERVATION MOVEMENT.

During the past year the movement to conserve the forests expanded into a movement for the conservation of all natural resources. Henceforward the practice of forestry must be regarded as a logical and necessary part of a broad and farsighted plan to make the most of the physical assets of the Nation.

Reform in the use of the forests and in public sentiment toward them led the way to this more comprehensive movement, which demands reform in the use of all the great resources. For a generation the effort to bring forestry into general practice and to educate the people in forest values went on, while no similar efforts were made to secure the wise use of the land, the waters, and the minerals. The progress in forestry, however, gradually led to a new point of view toward these other resources. The reclamation act was passed in 1901. Then came the reports of the Public Lands Commission (1905) and the Inland Waterways Commission (1907), revealing the losses which the people had sustained in the waste and neglect of the waters needed for power, irrigation, transportation, and domestic use; in the misappropriation and misuse of

the soils, and in the destructive extraction and consumption of the mineral ores and fuels.

The situation was seen to be so threatening that the President called the Governors' Conference at the White House in May, 1908. Before adjournment the governors adopted a declaration of principles which concluded with the words: "Let us conserve the foundations of our prosperity." Immediately thereafter the President appointed the National Conservation Commission, which he directed to make an inventory of the natural resources of the United States. The inventory was made and a report was submitted to the President in due course. Meanwhile in 37 of the States conservation commissions were appointed and 47 of the great associations of citizens interested in the use of natural resources appointed conservation committees.

To secure the cooperation of the two other nations of the North American continent was the important step next taken. The President invited the Governor-General of Canada and the President of Mexico to send representatives to take part with representatives of the United States in a conference on the conservation of the resources of North America. The invitations were cordially accepted, and the North American Conference met in Washington in February, 1909, when it adopted a declaration of principles. This declaration, in addition to many vigorous recommendations, contained a suggestion that the President invite all the nations to confer upon the conservation of world resources. Upon the adjournment of the North American Conference, invitations to such a world conference, to be held at The Hague in September, 1909, were sent to all the 45 nations which participated in The Hague Peace Conference in 1906.

As a result of the conservation movement, forestry in the United States has been placed upon a firmer footing and become part of a movement for better National economy in all directions. Furthermore, a mass of valuable material upon forests and forestry has been brought together in the report of the National Conservation Commission, which has been published by authority of Congress. Finally, the "declaration" of the North American Conference takes an advanced stand upon a number of the questions which most closely concern forestry in North America.

Forest Legislation.

The volume of new and amendatory forest legislation from December 1, 1907, to December 1, 1908, was very much smaller than in the preceding twelve months, such legislation having been enacted in only 10 States during that period as against 23 States in the year previous. This is due to the fact that nearly all the State legislatures meet in biennial sessions in the odd-numbered years.

The following is a brief summary of the laws passed by Congress and State legislative assemblies during the year ending December 1, 1908:

United States.—Appropriations aggregating $22,000 were made to enable the Secretary of the Interior to pay for advertising the restoration to the public domain of lands in National Forests or of lands temporarily withdrawn for National Forest purposes (35 Stat. L., 18 and 346); the Secretary of the Interior is authorized, upon certification of the Secretary of War, to exchange equal areas of unoccupied, nonmineral, nontimbered public land for private land needed for the enlargement of military maneuvering grounds within the Crow Creek National Forest (35 Stat. L., 42); the Secretary of the Interior is authorized to permit the cutting, manufacture, and sale of certain timber upon and otherwise providing for the preservation of forests in the Menominee Indian Reservation, the Forest Service to designate the timber to be cut (35 Stat. L., 52); in the lump sum appropriated for the Geological Survey the surveying of National Forests is included (35 Stat. L., 349); by continuing legislation, $75,000 is appropriated and made immediately available for the continuance of topographical surveys of National Forests by the Geological Survey (35 Stat. L., 350); the operation of the forest homestead act of June 11, 1906, is made applicable to certain counties in the State of California hitherto excepted by said act (35 Stat. L., 554).

The following changes were made (35 Stat. L., 251), affecting the general powers and duties of the Forest Service:

No part of the Forest Service appropriation to be used in making experiments outside the jurisdiction of the United States; the clause giving power to "advise owners of woodlots in the proper care of the same" omitted (this omission having been made by inadvertence, the words were restored in the next Congressional session); the maximum cost of buildings decreased from $1,000 to $500; "protect, administer, improve, and extend National Forests," changed to "protect, administer, and improve" (on account of this change, the appropriation is no longer available for the purchase of administrative sites for ranger stations); aid to be given upon request to other Federal Bureaus and Departments in respect to National Forests in the performance of duties imposed upon them by law; time limit for the exploitation of timber

from the Black Hills National Forest extended from July 1, 1908, to July 1, 1910; advances of money to chiefs of field parties fighting fire allowed in cases of emergency; limit of rent allotment discontinued; phraseology changed to "rent in the District of Columbia and elsewhere;" traveling expenses of Forest officers defined to be such as are incurred when on business directly connected with and in furtherance of the work, aims, and objects specified in the appropriation for the Forest Service; expenses in connection with newspaper and magazine articles authorized for the purpose of giving out facts or official information of value to the public; by continuing legislation a lump-sum appropriation of $600,000 is made for the construction and maintenance of permanent improvements, including roads, trails, bridges, fire lanes, telephone lines, cabins, fences, etc.; payment to States of money received from National Forests increased from 10 per cent to 25 per cent.

LOUISIANA.—A "commission on natural resources," consisting of the professor of horticulture of the State University, the chief engineer of the State board of engineers, and five others to be appointed by the governor, authorized; such commissioners to serve without salary, and such commission to cease at the expiration of the legislative session of 1910, unless then continued; the commission to report to the general assembly in 1910 upon State forest conditions, the preservation of the forests, the reforestation of denuded lands, and the effect of forest destruction on climatic conditions and waterways and their control, and to suggest necessary legislation in connection therewith (act 144, laws of 1908); a chair of forestry established in the Louisiana State University and Agricultural College at Baton Rouge, to teach the care, protection, and conservation of the forests of the State (act 242, laws of 1908).

MARYLAND.—For the purpose of carrying out provisions of the Maryland forestry act of 1906, $4,000 is appropriated for each of the years 1909 and 1910 (Ch. 215, laws of 1908); consent given to the acquisition by the United States, by purchase, gift, or condemnation, of such lands as may be needed for a National Forest reserve in the State, and granting Congress the right to make rules and regulations for its management (Ch. 217, laws of 1908).

MASSACHUSETTS.—Certain plantations of trees shall be exempt from taxation for ten years, if such land is devoted exclusively to the growth of trees (Ch. 120, laws of 1908); publications of the State forester designated by the governor and council may be sold at cost (Ch. 121, laws of 1908); the voters of each township to vote upon "An act to provide for the protection of forest and sprout lands from fire" (Ch. 209, laws of 1908); appropriation is made for the purchase by the State of land for reforestation, with the privilege to the owner of repurchasing within ten years upon payment of the original price with interest at 4 per cent together with whatever expenses have been incurred by the State (Ch. 478, laws of 1908).

NEW JERSEY.—Chapter 123 of the laws of 1906 is amended as to the appointment of fire wardens, prevention of forest fires, regulations as to the burning of brush, etc.; compensation for fire wardens' helpers, etc. (Ch. 213, laws of 1908); as a supplement to the forestry act of 1905 it is provided that the State shall annually pay to the treasurer of each township where the State holds a forest reserve the sum of 2 cents per acre for each acre thereof, payment to be made from the appropriation for the maintenance of such reserves (Ch. 214, laws of 1908).

NEW YORK.—Appropriation is made for traveling expenses, calcium light, photographic work, etc., in connection with lectures on forestry (Ch. 466, p. 1617, laws of 1908); provision is made for establishing additional nurseries for the propagation of forest trees, to be furnished to citizens of the State under the direction of the forest commissioner, and for reforesting denuded lands (p. 1618); provision is made for a "land-purchase board" for the acquisition of lands within the Adirondack Park (p. 1619); chapter 220 of the laws of 1897 and chapter 20 of the laws of 1900 are repealed, and a complete reenactment is made of the "forest, fish, and game law" of the State, which constitutes what is now chapter 31 of the general laws (Ch. 130, laws of 1908).

OHIO.—Eight thousand dollars are appropriated for experiments in forestry (laws of 1908, p. 547).

RHODE ISLAND.—Chapter 44 of the general laws is amended so as to exempt from taxation for the period of fifteen years and under certain regulations lands on which certain varieties of trees are planted, such lands to be under regulations of the commissioner of forestry (laws of 1908, p. 1581).

VERMONT.—Whenever the governor shall decide that, by reason of drought, it is dangerous to use firearms within forests, he may by proclamation abrogate the open season for hunting for such time as he thinks best, and all provisions of law for the close season shall be in force (law passed October 21, 1908).

VIRGINIA.—Section 437a of the act of 1907 is amended so as to require that, in the matter of assessment of taxes of standing merchantable timber, trees shall be assessed at a fair market value (Ch. 220, laws of 1908); section 3701 of the act of 1904 is amended so as to penalize more heavily the firing of woods by increasing the fine limit to $500 and the jail sentence to twelve months, or by permitting confinement in the penitentiary not less than one or more than three years (Ch. 42, laws of 1908); railroad companies are made liable for damage from sparks or coal from engines or trains, whether the fire originated on their right of way or not, and regardless of whether the engines are equipped with proper spark arresters, and also regardless of the condition of such spark arresters (Ch. 269, laws of 1908).

COURT DECISIONS.

Two court decisions were rendered during the year which ought to be noticed here because they will undoubtedly be the basis of considerable legislation in the future; proposed measures based on the principles which they enunciate have already been introduced in the legislatures of Pennsylvania, Maine, and New York.

UNITED STATES SUPREME COURT.—Hudson County Water Company *v.* McCarter (206 U. S. Rep., p. 349): The State, as quasi-sovereign and representative of the interests of the public, has a standing in court to protect the atmosphere, the water, and the forests within its territory, irrespective of the assent or dissent of the private owners of the land most immediately concerned.

MAINE SUPREME COURT.—In reply to certain questions submitted to it by the State senate (103 Maine, p. 506): The State may, by legislation, restrict or regulate the cutting of trees on wild or uncultivated land by the owner thereof, without compensation therefor to such owner, in order to prevent or diminish injurious droughts and freshets, and to protect, preserve, and maintain the natural water supply of springs, streams, ponds, lakes, etc., and to prevent or diminish injurious erosion of the land and the filling up of the rivers, ponds, lakes, etc. Such legislation is not "taking" private property within the inhibition of the Constitution.

IMPORTANT FOREST LEGISLATION SINCE DECEMBER 1, 1908.

On December 18, 1908, the State of Vermont passed a comprehensive forest law containing the following features: A State board of agriculture and forestry created, consisting of the governor, director of the agricultural experiment station, and two citizens interested in forestry, such board to serve without compensation; a State forester to be appointed by the board, whose salary shall not exceed $2,500, and who shall be ex officio State fire warden and have full charge of forestry interests in the State; practical, administrative, experimental, and educational; the governor is authorized, on the recommendation of the board, to accept gifts of land for State forest reserves, and the board may purchase lands for the same purpose; State to pay taxes to towns upon lands held in such reserves; part of the appropriation may be used by the forester further to develop the nursery for seedlings and supply such to private lands, as provided by aw; all authority and duties now devolving on the forestry commissioner shall devolve upon and be executed by the State forester.

On February 18, 1909, Congress passed the act to create the Calaveras Bigtree National Forest, by which the Secretary of Agriculture was empowered to obtain for the United States the complete title to certain lands in California, in order to secure for the United States and protect for all time the big trees scientifically known as *Sequoia washingtoniana*.

On February 26, 1909, Congress amended the act to establish a court of private land claims, known as the "small-holdings act," so as to extend the provisions thereof from March 4, 1901, to March 4, 1910.

On March 2, 1909, Congress extended the time for the completion of the Valdez, Marshall Pass and Northern Railroad Company as far as Tenana, to March 2, 1915. (The line of this railroad lies partly in the Chugach National Forest.)

On March 3, 1909, Congress, in the Indian appropriation act, authorized the Commissioner of Indian Affairs to investigate the condition of timber on Indian reservations, to advise the Indians as to the proper care of their forests, and to conduct such timber operations and sales as may be deemed advisable. The Menominee Indian Reservation was excepted.

On March 4, 1909, Congress passed amendments to the penal laws of the United States with reference to depredations of, "boxing," and setting fire to the timber on public lands; failing to extinguish forest fires; breaking the fence or gate inclosing any reserved land; and injuring or removing Government survey marks or interrupting surveys; amendments to take effect January 1, 1910.

On March 2, 1909, the State of Wyoming passed a law providing for the appointment of National Forest guards as assistant State game wardens.

On March 12, 1909, the State of Kansas passed a law providing for the establishment of a division of forestry at the State Agricultural College, and for the appointment of a State forester, who shall have charge of all experimental work at the college and promote practical forestry in the State by lecturing, by keeping the public informed as to results of experimental work, and by cooperation with all persons, towns, etc., in the management and protection of woodlots and forests.

On March 19, 1909, the State of Montana passed a voluminous law dealing with the administration and control of all its public lands, in which the following matters are provided for: The payment of a fixed fee for the issuance of a permit to cut live timber; the appointment of a State forester, at a salary of $2,500 (and of an assistant forester when necessary), setting forth his duties with respect to State fire wardens, the enforcement of fire laws, the delivery of lectures, the preparation of reports, the appointment of volunteer fire wardens (with a provision that National Forest supervisors and rangers may be such), and the general administration of forest lands; the punishment by fine and imprisonment of those who destroy official forest signs or notices; a forestry board with powers as to the reforestation of denuded lands and the conservation of forest tracts on the watersheds of the State; the keeping of records as to the location, character, and sales of forest lands; and regulations for the cutting and sale of timber on State lands.

On May 22, 1909, the State of New York passed a law providing for "The Highlands of the Hudson Forest Reservation," authorizing the Forest, Fish and Game Commission to maintain the lands therein according to the methods of modern forestry, to take by purchase, gift, or devise private lands included therein and to control the cutting of timber upon such public and private lands therein "as are suitable for the growth of timber only, to the end that the forest and timber upon such lands shall be protected."

This is the most advanced step which has yet been taken in behalf of forestry by any State legislature and is the enactment into law of the principles laid down in decisions by the United States Supreme Court in the case of Hudson County Water Company against McCarter (206 U. S., p. 349) and by the supreme court of the State of Maine (103 Maine, p. 506). The substance of these decisions is stated above.

FOREST PRODUCTS.

Quantity and value of slack cooperage stock produced, 1907.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture. The figures shown represent the production of 950 mills.]

Kind of wood.	Staves.			Heading.			Hoops.		
	Quantity (thousands).	Value.	Average value per thousand.	Quantity (thousand sets).	Value.	Average value per thousand sets.	Quantity (thousands).	Value.	Average value per thousand.
Total	1,175,977	$7,219,497	$6.14	106,074	$5,062,890	$47.73	490,570	$3,517,866	$7.17
Gum	210,814	1,238,980	5.88	11,466	665,127	58.04	1,840	21,841	11.87
Pine	205,878	1,063,394	5.17	27,208	1,107,819	40.72	3,996	23,829	5.96
Elm	158,440	1,192,327	7.53	9,165	432,618	47.20	469,734	3,393,911	7.22
Beech	125,354	790,415	6.31	17,711	707,692	39.96			
Maple	97,319	609,986	6.27	11,695	548,610	46.91	1,747	5,571	3.19
Spruce	76,445	392,881	5.14	2,555	105,432	41.26			
Chestnut	74,982	339,850	4.53	733	32,030	43.70	2,000	6,000	3.00
Ash	70,128	557,866	7.96	7,434	435,083	58.53	1,580	13,045	8.26
Cottonwood	46,923	317,566	6.77	1,784	117,860	66.07			
Oak	37,871	259,892	6.86	2,814	132,964	47.25	2,775	15,388	5.55
Birch	21,479	135,420	6.30	2,146	116,565	54.32	2,489	10,086	4.05
Basswood	18,640	130,525	7.00	9,585	571,766	59.65			
Hemlock	16,535	87,975	5.32	574	27,086	47.19			
Sycamore	2,579	16,673	6.46	297	11,340	38.18			
Hickory							3,708	21,990	5.93
All other	12,590	85,747	6.81	907	50,898	56.12	701	6,205	8.85

Production and average mill value of lumber, 1907 and 1906, by States.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture.]

State.	Rank 1907	Number of mills reporting.		Quantity (M feet b. m.).		Per cent of increase.	Per cent of total cut.	
		1907	1906	1907	1906		1907	1906
United States	......	28,850	22,398	40,256,154	37,550,736	7.2	100.0	100.0
Washington	1	1,036	923	3,777,606	4,305,053	[a]12.3	9.4	11.5
Louisiana	2	531	424	2,972,119	2,796,395	6.3	7.4	7.4
Texas	3	673	322	2,229,590	1,741,473	28.0	5.5	4.6
Mississippi	4	823	642	2,094,485	1,840,250	13.8	5.2	4.9
Wisconsin	5	778	625	2,003,279	2,331,305	[a]14.1	5.0	6.2
Arkansas	6	1,146	835	1,988,504	1,839,368	8.1	4.9	4.9
Michigan	7	906	774	1,827,685	2,094,279	[a]12.7	4.5	5.6
Pennsylvania	8	2,131	1,482	1,734,729	1,620,881	7.0	4.3	4.3
Minnesota	9	429	318	1,660,716	1,794,144	[a]7.4	4.1	4.8
Oregon	10	644	557	1,635,563	1,604,894	1.9	4.1	4.3
North Carolina	11	1,668	1,210	1,622,387	1,222,974	32.7	4.0	3.3
Virginia	12	1,652	1,202	1,412,477	1,063,241	32.8	3.5	2.8
West Virginia	13	1,044	652	1,395,979	976,173	43.0	3.5	2.6
California	14	321	269	1,345,943	1,348,559	[a].2	3.3	3.6
Alabama	15	892	637	1,224,967	1,009,783	21.3	3.0	2.7
Maine	16	927	734	1,103,808	1,088,747	1.4	2.8	2.9
Kentucky	17	1,451	991	912,908	661,299	38.0	2.3	1.8
Tennessee	18	1,104	684	894,968	634,587	41.0	2.2	1.7
Georgia	19	788	622	853,697	831,675	2.6	2.1	2.2
New York	20	2,185	2,488	848,894	810,949	4.7	2.1	2.1
Florida	21	302	278	839,058	888,137	[a]5.5	2.1	2.4
New Hampshire	22	544	552	754,023	539,259	39.8	1.9	1.4
South Carolina	23	365	296	649,058	566,928	14.5	1.6	1.5
Missouri	24	916	587	548,774	507,084	8.2	1.4	1.3
Ohio	25	987	688	529,087	438,775	20.6	1.3	1.2
Idaho	26	247	198	513,788	418,944	22.6	1.3	1.1
Indiana	27	999	820	504,790	447,808	12.7	1.3	1.2
Vermont	28	612	514	373,660	329,422	13.4	.9	.9
Massachusetts	29	518	485	364,231	354,483	2.7	.9	.9
Montana	30	130	84	343,814	328,727	4.6	.9	.9
Maryland	31	307	222	213,786	219,098	[a]2.4	.5	.6
Iowa	32	100	78	144,271	163,747	[a]11.9	.4	.4
Illinois	33	499	365	141,317	141,374	.1	.4	.4
Oklahoma	34	129	51	140,015	49,737	181.5	.3	.1
Connecticut	35	236	207	140,011	124,880	12.1	.3	.3
Colorado	36	230	138	134,239	110,212	21.8	.3	.3
New Mexico	37	52	33	113,204	103,079	9.8	.3	.3
Arizona	38	12	8	72,134	56,960	26.6	.2	.2
Delaware	39	106	85	50,892	44,487	14.4	.1	.1
New Jersey	40	166	139	39,942	36,253	10.2	.1	.1
South Dakota	41	64	40	34,841	22,634	53.9	.1	.1
Rhode Island	42	41	31	32,855	21,528	52.6	.1	.1
Wyoming	43	73	49	17,479	13,213	32.3	(b)	(b)
Utah	44	80	57	14,690	7,768	89.1	(b)	(b)
All other States[c]	......	6	2	5,891	170	....	(b)	(b)

[a] Decrease. [b] Less than one-tenth of 1 per cent. [c] Includes Kansas and Nevada.

Production and average mill value of lumber, 1907 and 1906, by species.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture.]

Kind.	Rank 1907	Quantity (M feet b. m.). 1907	1906	Per cent of increase.	Per cent of total cut. 1907	1906
Total	......	40,256,154	37,550,736	7.2	100.0	100.0
Yellow pine	1	13,215,185	11,661,077	13.3	32.8	31.1
Douglas fir	2	4,748,872	4,969,843	a 4.4	11.8	13.2
White pine	3	4,192,708	4,583,727	a 8.5	10.4	12.2
Oak	4	3,718,760	2,820,393	31.9	9.2	7.5
Hemlock	5	3,373,016	3,537,329	a 4.7	8.4	9.4
Spruce	6	1,726,797	1,644,987	5.0	4.3	4.4
Western pine	7	1,527,195	1,386,777	10.1	3.8	3.7
Maple	8	939,073	882,878	6.4	2.3	2.4
Yellow poplar	9	862,849	677,670	27.3	2.2	1.8
Cypress	10	757,639	839,276	a 9.7	1.9	2.2
Red gum	11	689,200	453,678	51.9	1.7	1.2
Chestnut	12	653,239	407,379	60.4	1.6	1.1
Redwood	13	569,450	659,678	a 13.7	1.4	1.8
Beech	14	430,005	275,661	56.0	1.1	.7
Birch	15	387,614	370,432	4.6	1.0	1.0
Basswood	16	381,088	376,838	1.1	.9	1.0
Cottonwood	17	293,161	269,458	8.8	.7	.7
Elm	18	260,579	224,795	15.9	.6	.6
Ash	19	252,040	214,460	17.5	.6	.6
Cedar	20	251,002	357,845	a 29.9	.6	1.0
Larch	21	211,076	166,078	27.1	.5	.4
Hickory	22	203,211	148,212	37.1	.5	.4
White fir	23	146,508	104,329	40.4	.4	.3
Sugar pine	24	115,005	133,640	a 14.0	.3	.4
Tamarack	25	113,433	123,395	a 8.1	.3	.3
Tupelo	26	68,842	47,882	43.8	.2	.1
Balsam fir	27	53,339	(b)	....	.1	....
Sycamore	28	46,044	(b)	....	.1	....
Walnut	29	41,490	48,174	a 13.9	.1	.1
All other	......	27,734	164,845	a 83.2	.1	.4

a Decrease. b Not shown separately in 1906.

Production of shingles, 1907, by species.

Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture.]

Kind.	Quantity (thousands).	Per cent of total.	Total value.	Average value per thousand.
Total	11,824,475	100.0	$30,111,337	$2.55
Cedar	8,604,399	72.0	21,542,344	2.50
Cypress	1,232,314	10.3	3,579,676	2.90
Redwood	707,421	7.0	1,440,869	2.04
Yellow pine	620,292	5.2	1,556,236	2.51
White pine	216,611	1.8	712,313	3.29
Hemlock	162,647	1.4	493,569	3.03
Spruce	134,060	1.1	347,890	2.60
Chestnut	54,815	.5	186,302	3.40
Oak	20,628	.2	64,058	3.11
All other species	71,288	.6	188,080	2.64

Number and cost of cross-ties purchased by steam and by electric railroads in the United States in 1907, by kinds.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture.]

Kind.	Total.			Steam railroads.					
				Hewed.			Sawed.		
	Number.	Total cost.	Average cost per tie.	Number.	Total cost.	Average cost per tie.	Number.	Total cost.	Average cost per tie.
Total	153,699,620	$78,958,695	$0.51	112,309,246	$56,522,768	$0.50	31,776,434	$17,020,882	$0.54
Oaks	61,757,418	32,985,122	.53	51,169,478	26,774,251	.52	6,929,572	4,033,150	.58
Southern pines	34,215,081	18,434,198	.54	25,629,749	13,100,589	.51	7,415,686	4,569,060	.62
Douglas fir	14,524,266	6,818,869	.47	1,436,258	590,754	.41	12,366,640	5,884,822	.48
Cedar	8,953,205	4,473,960	.50	7,941,152	3,987,035	.50	396,891	190,322	.48
Chestnut	7,851,325	3,772,048	.48	4,922,831	2,337,697	.47	889,420	426,523	.48
Cypress	6,778,944	3,099,439	.46	5,695,640	2,552,381	.45	884,915	453,058	.51
Western pine	5,019,247	2,515,798	.50	3,206,754	1,576,457	.49	1,626,330	835,895	.51
Tamarack	4,562,190	2,254,617	.49	4,144,127	2,083,646	.50	340,618	137,481	.40
Hemlock	2,366,459	807,241	.34	2,283,675	770,969	.34	79,256	34,796	.44
Redwood	2,030,982	1,198,497	.59	884,552	507,154	.57	406,519	224,525	.55
Lodgepole pine	666,916	332,984	.50	666,916	332,984	.50			
White pine	474,455	193,606	.41	289,624	106,528	.37	131,671	53,041	.40
All other	4,499,132	2,072,316	.46	4,038,490	1,802,323	.44	308,916	178,209	.58

Kind.	Electric railroads.					
	Hewed.			Sawed.		
	Number.	Total cost.	Average cost per tie.	Number.	Total cost.	Average cost per tie.
Total	6,074,291	$3,376,477	$0.56	3,539,649	$2,038,568	$0.58
Oaks	2,532,970	1,483,468	.59	1,125,398	694,253	.62
Southern pines	597,221	356,111	.60	572,425	408,438	.71
Douglas fir	194,807	96,095	.49	526,561	247,198	.47
Cedar	420,552	199,646	.47	194,610	96,957	.50
Chestnut	1,407,479	697,843	.50	631,595	309,985	.49
Cypress	184,634	86,015	.47	13,755	7,985	.58
Western pine	48,200	27,611	.57	137,963	75,835	.55
Tamarack	8,007	3,320	.41	69,438	30,170	.43
Hemlock	3,528	1,476	.42			
Redwood	600,290	379,795	.63	139,621	87,023	.62
Lodgepole pine						
White pine	4,129	2,079	.50	49,031	31,958	.65
All other	72,474	43,018	.59	79,252	48,766	.62

Comparative summary of the quantity and value of tanning materials consumed in 1907 and 1906.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture. 583 plants reported in 1907, and 617 plants in 1906.]

Kind.	Tanbark. 1907 Quantity (cords).	Tanbark. 1907 Value.	Tanbark. 1906 Quantity (cords).	Tanbark. 1906 Value.	Extracts. 1907 Quantity (pounds).	Extracts. 1907 Value.	Extracts. 1906 Quantity (pounds).	Extracts. 1906 Value.
Total	1,214,401	$11,555,874	1,371,342	$12,774,071	364,899,535	$9,649,673	329,389,405	$8,713,322
Hemlock	815,840	7,016,915	931,152	7,902,393	40,133,524	968,041	34,405,978	846,726
Oak	374,052	3,933,038	429,161	4,585,186	30,830,291	639,938	30,192,151	598,299
Chestnut					134,819,100	2,560,007	128,535,018	2,346,884
Quebracho					145,324,677	4,995,807	133,508,306	4,817,012
Palmetto					486,980	12,502	595,261	14,887
All other	24,509	605,921	11,029	286,492	13,304,963	473,378	2,152,691	89,514

Comparative summary of the quantity of wood used for the manufacture of pulp in 1907, 1906, and 1905, by kinds.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture.]

Kind.	1907 Total (cords).	1907 Per cent.	1906 Total (cords).	1906 Per cent.	1905 Total (cords).	1905 Per cent.
Total	3,962,660	100.0	3,661,176	100.0	3,192,123	100.0
Spruce:						
Domestic	1,795,278	45.3	1,785,680	48.8	1,650,709	51.7
Imported	905,575	22.9	721,322	19.7	622,545	19.5
Poplar:						
Domestic	352,142	8.9	310,920	8.5	299,175	9.4
Imported	19,798	.5	17,550	.5	22,883	.7
Hemlock	576,154	14.5	528,381	14.4	375,422	11.8
Pine	78,583	2.0	69,277	1.9	57,399	1.8
Cottonwood	66,084	1.7	(a)		10,507	.3
Balsam	43,884	1.1	33,886	.9	56,744	1.8
Miscellaneous	125,162	3.2	[b] 194,100	5.3	96,739	3.0

[a] Included with miscellaneous. [b] Includes cottonwood.

Comparative summary of the material used and the products obtained in pine distillation in 1907 and 1906.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture. Based upon reports from 31 establishments in 1907 and 32 establishments in 1906.]

Kind.	1907 Quantity.	1907 Value.	1906 Quantity.	1906 Value.
Material:				
Longleaf pine, cords	61,149	$210,604	50,234	$129,358
Sawdust, cords	1,200			
Products:				
Total		534,802		380,170
Turpentine, gallons	654,711	304,860	503,427	238,612
Charcoal, bushels	1,158,364	102,411	791,887	44,381
Oil, gallons	391,916	69,399	125,008	17,429
Tar, gallons	760,836	58,132	648,120	64,368
Pyroligneous acid, gallons			305,000	15,380

Quantity and value of tight barrel staves and heading produced in 1907 and 1906.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture. Based upon reports from 376 establishments in 1907 and 241 establishments in 1906.]

Kind.	Staves.					
	1907			1906		
	Quantity (thousands).	Value.	Average value per thousand f. o. b. point of manufacture.	Quantity (thousands).	Value.	Average value per thousand f. o. b. point of manufacture.
Total	385,232	$12,942,885	$33.60	267,827	$8,389,642	$31.32
Sawed	325,653	9,062,678	27.83	219,524	5,746,780	26.18
Bucked and split	25,082	1,277,104	50.92	18,352	866,821	47.23
Hewed	12,737	1,513,203	118.80	9,781	915,740	93.62
Beer and ale	21,760	1,089,900	50.09	20,170	860,301	42.65

Kind.	Heading.					
	1907			1906		
	Quantity (sets).	Value.	Average value per set f. o. b. point of manufacture.	Quantity (sets).	Value.	Average value per set f. o. b. point of manufacture.
Total	27,692,994	$6,864,485	$0.25	17,774,375	$3,999,630	$0.23
Sawed	25,828,909	6,367,738	.25	16,115,030	3,612,281	.22
Beer and ale	1,864,085	496,747	.27	1,659,345	387,349	.23

Comparative summary of the quantity and cost of poles purchased by telephone and telegraph companies, steam railroad companies, and electric railroad and electric light and power companies, in 1907 and 1906.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture.]

Species.	1907			1906		
	Number.	Cost at point of purchase.	Average cost per pole.	Number.	Cost at point of purchase.	Average cost per pole.
Total	3,507,998	$10,229,642	$2.92	3,574,666	$9,471,171	$2.65
Cedar	2,221,842	6,559,169	2.95	2,174,279	5,579,891	2.57
Chestnut	630,282	1,619,785	2.57	988,084	2,625,568	2.66
Cypress	212,733	1,099,296	5.17	111,657	256,950	2.30
Pine	155,960	459,545	2.95	177,809	686,803	3.86
Oak	76,450	60,285	.79	9,924	13,951	1.41
Juniper	38,925	109,226	2.81	57,064	163,437	2.86
Redwood	31,469	109,478	3.48	24,760	87,189	3.56
Fir	15,919	40,720	2.56	9,601	21,637	2.25
Tamarack	13,884	10,247	.74	....	....	....
All other	110,534	161,891	1.46	21,488	35,745	1.68

Quantity and value of material used and quantity of veneer produced, by kinds of wood, 1907.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture.]

Kind.	Material used.			Product.	
	Quantity (thousand feet, log scale).	Cost.	Average cost per thousand feet, log scale.	Rotary cut (thousand square feet).	Sawed or sliced (thousand square feet).
Total	348,523	$6,436,237	$18.47	2,223,378	433,446
Domestic:					
Red gum	102,932	1,068,897	10.38	719,059	20,369
Cottonwood	33,174	438,234	13.21	151,067	2,238
Yellow pine	32,450	269,032	8.29	160,769	10,028
Yellow poplar	28,764	615,433	21.01	186,924	13,738
Maple	28,175	394,914	14.02	307,362	5,805
White oak	23,872	848,855	35.56	41,695	145,217
Birch	18,079	281,099	15.55	148,010	9,831
Tupelo	15,097	158,860	10.52	89,925	1,157
Basswood	13,561	244,059	18.00	75,203	2,790
Elm	12,615	191,741	15.20	83,855	2,610
Spruce	6,060	95,239	15.72	78,455	65
Red oak	4,629	148,068	31.99	30,554	3,972
Beech	4,367	56,164	12.86	40,610	959
Walnut	3,952	278,197	70.39	40,006	2,021
Sycamore	3,554	35,399	9.96	21,331	226
Ash	2,818	61,622	21.87	21,166	3,109
Chestnut	400	5,813	14.53	2,324	
Hemlock	233	2,826	12.13	15	594
Buckeye	118	1,360	11.53	469	
Hickory	100	1,000	10.00		1,500
Douglas fir	90	1,620	18.00	450	
Magnolia	90	1,391	15.46	967	25
Cherry	20	400	20.00	400	
All other [a]	1,729	32,204	18.63	10,666	4,555
Imported:					
Mahogany	6,722	839,695	124.92	10,096	113,693
Spanish cedar	3,922	284,115	72.44		74,944
All other [a]	1,000	80,000	80.00	2,000	14,000

[a] Kind not specified.

Comparative summary of the material used and the products obtained in hard-wood distillation in 1907 and 1906.

[Compiled by the Bureau of the Census, Department of Commerce and Labor, in cooperation with the Forest Service, Department of Agriculture. Based upon reports from 100 establishments in 1907 and 86 establishments in 1906.]

Kind.	1907		1906	
	Quantity.	Value.	Quantity.	Value.
Material:				
Wood, chiefly beech, birch, and maple, cords	1,219,771	$3,824,669	1,144,896	$3,716,423
Products:				
Total		7,661,379		7,763,116
Charcoal, bushels	50,772,234	3,838,392	45,657,721	2,965,940
Crude alcohol, gallons	7,741,645	1,153,307	7,871,494	2,676,191
Gray acetate, pounds	133,374,941	2,565,938	96,376,497	2,017,331
Brown acetate, pounds	8,152,848	94,446	6,960,933	85,777
Oils, gallons	382,959	9,296	250,610	19,877

SOME SPECIAL ASPECTS OF CHEMICAL INVESTIGATIONS IN 1908.

Compiled in the Bureau of Chemistry.

Miscellaneous Food Investigations.

Studies have been made of the manufacturing processes employed in the preparation of many foods, and methods have been elaborated for the more satisfactory grading of some varieties of canned vegetables which make it possible to judge in a much more satisfactory manner the quality of the food in question. The preparation of canned shrimp has been studied and the conditions under which it is possible to prepare this product without the use of a chemical preservative have been partially determined. The enforcement of the prohibition laws in the South has made it highly important to procure a new method of utilizing varieties of grapes grown in those localities and formerly used for the preparation of wine. The methods employed for the preparation of grape juice from the Northern varieties of grapes have not been found to be entirely applicable to the Southern grapes, and an endeavor has been made to adapt the method to Southern conditions and products. A method for the preparation and preservation of a satisfactory product of unfermented juice from the Catawba grape has been developed, but the work with the Scuppernong grape has not been entirely satisfactory, owing to the difficulty of completely removing turbidity and retaining the flavor of the grape. Much progress in this direction has, however, been made.

Experimental work on the drying of the persimmon has been continued and the process has been put on a satisfactory commercial basis. It is believed that the preparation of this product will afford a better market than now exists for the Japanese persimmons grown in the United States and will make accessible a valuable food.

A study of the Sicilian lemon oils, begun during 1907, has been continued with a view to securing data that would be of value in determining the variety of lemon oils and extracts on the market. By the examination of a large number of samples of known purity the limits of composition of normal Sicilian lemon oil have been definitely determined.

Considerable attention has been given to the methods of handling and shipping oysters. The various methods employed in the shipment of oysters have been carefully studied and the fresh oysters compared by chemical methods and organoleptic tests with the oysters prepared by different methods for shipment. It is apparent from the results obtained that the practices of prolonged soaking in water and shipment in contact with ice are objectionable and result not only in impaired flavor, but also in earlier decomposition. By shipment in closed packages surrounded by ice and without the addition of water, with the exception of a brief washing immediately after taking from the shell, it is possible to ship to interior cities, or even across the country, oysters of very superior flavor.

A special study has been made of tomato ketchup with a view to determining the nature of the material from which it is manufactured, and methods have been elaborated by which the ketchup prepared from whole fruit may be distinguished from that prepared from the ordinary skin and core pulp. In general much progress has been made in the methods employed for the examination of food. Accurate quantitative determinations of benzoic acid when present even in very small quantities, in this and other food products, can now be made.

Storage Conditions Affecting the Quality of Poultry as Food.

Both the laboratory and the inspection work along these lines early showed how important a factor in the condition of the stored foods is the handling which precedes storage. Therefore, products of known history which have been subjected to prompt and careful handling have been investigated side by side with the same products which had been treated according to commercial methods. Very marked resultant differences in the keeping qualities of foods have thus been demonstrated, depending in the case of fowls upon such factors as the mode of killing, bleeding, picking, cooling, etc. Such a line of work led, logically, to the general study of putridity and decomposition in foods; the bacteria concerned, the structural degeneration of the tissues and the chemical products resulting, as affected by environment or treatment.

The gradual extension of the tracing of cause and effect has carried the work into the industry as well as into the laboratory. The overwhelming evidence of the need for the study of poultry, as shown by the enormous amount of low grade, if not actually harmful, produce on the market, the desire of the industry to better its product, and the demand of the people for wholesome food, has developed into a general investigation by this Bureau of the handling, dressing, shipping, packing, cooling, and freezing of poultry and such other factors as influence the quality of poultry as a food.

A very comprehensive campaign and an organization of forces must be effected in order to accomplish the best results. Packing-house methods for poultry in various parts of the country are being studied; transportation facilities must influence greatly the ultimate conditions of the market stock, yet factors preceding and subsequent to either long or short hauls must be given due consideration; the sojourn in the storage warehouse—whether long or short—must be taken into account, and the many and varied vicissitudes which the birds undergo between the hands of the commission man and the consumer must be traced as far as possible. Much time during the latter part of the year 1908 has been given to formulating these plans, arranging with packers, shippers, warehousemen, and the industry all along the line for their cooperation. While many phases of the work are still tentative, sufficient progress has been made to publish a preliminary report on the effect of cold storage on poultry, quail, and eggs (Bulletin 115, Bureau of Chemistry), and to present to the First International Congress of Refrigerating Industries, held in Paris in October, 1908, an article entitled "A Chemical, Bacteriological, and Histological Study of Cold-Stored Poultry."

Progress in Drug Work.

METHODS OF ANALYSIS.

During the year 1908 substantial progress was made along various lines. It is of the utmost importance to be in possession of satisfactory and reliable methods of analysis, and for that reason, the first item deserving consideration is the work done in testing the reliability of existing methods, and devising new and improved methods of analysis. A number of experienced workers took part in the cooperative work on the assaying of drugs, and the results obtained are of the utmost significance; they emphasize the fact that much discretion must be exercised in basing deductions upon data obtained by the present methods for determining the active constituents in plant products and preparations in the manufacture of which the same are used. The collaboration in studying, devising, and establishing methods for determining the various ingredients present in headache mixtures has been productive of excellent results. The data obtained were very concordant and indicate that the present methods may be satisfactorily employed for the more simple mixtures. The methods for determining the amount of alcohol present in various medicinal preparations were also studied, namely, the ordinary distillation method, the ebullioscope method, and the immersion refractometer method, with the result that the distillation method was found to give the most reliable and satisfactory results. In the case of elixirs or other products containing volatile oils it is necessary to remove the same by suitable treatment before subjecting them to distillation. It is also interesting to note in this connection that the amount of alcohol declared upon the labels of medicinal remedies so far examined is found to be in fair accord with the findings of the Drug Division.

It has been a common practice to add capsicum to ginger ale for the purpose of imparting to this product a degree of pungency which apparently can not be obtained from ginger to the satisfaction of the manufacturer. A good method for determining the presence of capsicum in such mixtures, however, was not available, and considerable experimental work was done, with the result that a method has been developed which enables an experienced worker to detect minute quantities of capsicum when present in ginger ale.

QUALITY OF DOMESTIC AND IMPORTED CRUDE DRUGS.

A large number of domestic samples of powdered drugs was collected and examined, and only a few were found to fall below the standard prescribed by the Pharmacopœia, exclusive of the degree of fineness. In a few cases adulteration was marked; for example, a sample of ipecac contained only about one-sixth of the prescribed alkaloidal material, being adulterated with ground olive pits. The quality of crude drugs offered for importation into the United States during the past year has materially improved. When inspection was instituted at the ports, gross adulteration was prevalent. At first it was found necessary to deny entry to many consignments, but the character of the goods gradually improved, so that at present few consignments of crude drugs are excluded.

QUALITY OF HYDROGEN PEROXID AND GLYCERIN.

All of the available brands of hydrogen peroxid were purchased and submitted to analysis. The examination showed that most of these, contrary to the general belief, are comparatively stable for at least six months. With few exceptions, all complied with the legal standard. At the expiration of one year the strength in all cases had

materially deteriorated, and in a few instances the product was virtually worthless. The various makes of glycerin were also examined, with the result that all domestic products were found to comply with the legal standard, except that certain odoriferous volatile bodies were present which are proscribed by the standard. A foreign glycerin hitherto considered of the highest grade was found to be the poorest product on the market.

PRESCRIPTION SCHEME REMEDIES.

A list of so-called prescription scheme remedies has been analyzed. This class of products is placed on the market largely for the purpose of evading the food and drugs act and deceiving the consumer. The representations used in exploiting them are largely of a false and misleading character, but appear generally in newspapers and other publications, which are apparently at present not within the jurisdiction of the law.

VIOLATIONS AND SUCCESSFUL PROSECUTIONS.

A number of preparations have been found in violation of the food and drugs act, and successful prosecutions have followed. Among these may be mentioned the following:

Adulterated saltpeter; Bouvier's buchu gin; concentrated oil of pine; Eyelin; Gowan's pneumonia cure; Hancock's liquid sulphur; Harper's brain food; Madame Yale's remedies; misbranding of cocain, by Roach Abell; Radol, a cancer cure; Sartorin skin food.

LEGISLATION.

A revision of Bulletin No. 98 entitled "Drug Legislation in the United States" has been issued. This is a compilation of the Federal, State, and Territorial laws governing the sale, importation, manufacture, and misbranding of medicinal products. Thirty-one States of the Union have passed laws similar to the Federal act which are at present in force. The result of this legislation has created a demand for qualified drug chemists which it is not possible to meet. A number of educational institutions have introduced special courses, intended to give instructions relative to the examination of foods and drugs, and the standards along these lines have been materially raised, with a view to educating men who will be able to qualify as chemists under the rules of the Department.

WORK OF THE MISCELLANEOUS DIVISION.

FEEDING STUFFS.

The extensive and important studies on feeding stuffs which have been in progress for several years have been completed and issued during the past year, one on Commercial Feeding Stuffs of the United States: Their chemical and microscopical examination (Bul. 108, by Haywood, Warner, and Howard) and the other on the Feeding Value of Cereals as Calculated from Chemical Analyses (Bul. 120, by Chamberlain). The former report shows quite a number of cases of adulteration and false branding. Two hundred and thirty different brands of commercial feeds were carefully analyzed and those constituents determined which are not usually included in the experiment station analyses. The complete data afforded will be of special value to those desiring to know the average composition of different brands of American concentrated feeds, and in connection with the information afforded in the other report, giving the chemical composition and comparative nutritive value of the different cereals entering into such feeds, the buyer is afforded ample data for deciding on the kind of feed that best suits a given condition.

POTABLE WATERS.

A large number of samples of lithia water have been examined under the food and drugs act and a considerable number of prosecutions recommended on the ground that no lithia, or only a spectroscopic trace, was present. A number of waters labeled as natural waters were found to be entirely artificial and others carried exaggerated or entirely false statements as to their therapeutic value. Others sold only on the basis of exceptional purity were found to contain the colon bacillus, thus indicating fecal contamination such as to make them totally unfit for human use. All of these waters were purchased on the open market, and at the same time the examination of samples taken at the source of the various springs was continued.

GAS SUPPLY.

A careful study was made of the conditions under which gas stoves and gas water heaters may give rise to carbon monoxid, a poisonous gas presenting special dangers, because it is nonodorous. The investigation resulted in certain recommendations as to the construction and installation of such heaters and led to a special message from the President to Congress, calling attention to the desirability of legislation regulating the quantities of this gas present in the gas supply of the District of Columbia.

INSECTICIDES.

An investigation important to fruit growers and orchardists was that in regard to the composition and burning qualities of the lead arsenate on the market for spraying purposes. Two of the samples examined proved to be composed entirely of white arsenic, a compound which would either kill the trees or seriously injure them. An explanation has also been found for the fact that lead arsenate sometimes burns the foliage and sometimes does not, and it is expected that this information will lead to the control of the difficulty.

SMELTER FUMES.

Investigations extending over a number of years and conducted in cooperation with the Forestry Service and the Department of Justice have been reported from time to time, but during the year 1908 the most important report yet made has been completed,[a] based on which certain Tennessee smelters have been compelled, by the decision of the Supreme Court, to condense the fumes issuing from their chimneys for the protection of property in Georgia.

This is the most important smelter decision yet rendered, and in consequence of it and the application of chemistry to the problem large sulphuric-acid plants have been erected at Ducktown, Tenn., in connection with the smelter, and what was once an injurious waste is being converted into a tremendously profitable by-product. A further economic advantage which will undoubtedly accrue is the fall in the price of acid phosphate, largely used as a fertilizer throughout the South, since the sulphuric acid made from the fumes is used to manufacture from phosphate rock, found in large quantities practically at the door of the smelter, the acid-phosphate fertilizer.

Environment Studies.

WHEAT.

Investigations to determine the influence of environment on the composition of wheat have been continued, and results now at hand show how the composition has varied during four years of experimentation. These results refer to the so-called triangular experiments, which consist in growing wheat continuously from the same original seed in each of the three points of a triangle; for example, Kansas, Texas, and California, or South Dakota, Kansas, and California. The crop from each apex is then sent to the other two stations and there grown alongside of the continuously grown seed. We thus have three plats at each apex or station, all from the same original seed, one plat grown continuously at that point, while the other two plats are planted with seed coming from the other two points of the triangle. Thus, by this interchange of seed, it is possible to determine the influence of climate and soil and that of the seed on the composition of the crop. The samples were collected each year and analyzed chemically and physically. The results show that all three plats at any one locality give seed identical in composition and in appearance, while the same seed grown at the three different stations vary in a marked degree. For example, Crimean wheat from the same source when grown in Kansas, in California, and in Texas during 1907 had the following composition in the three localities:

Data on Crimean wheat grown in three localities.

Determination.	Kansas.	California.	Texas.
Protein .... per cent..	22.3	11.0	17.6
Weight per 1,000 grains .... grams ...	21.0	33.4	23.0
Weight per bushel .... pounds ..	51.0	61.7	58.0

[a] U. S. Department of Agriculture, Bureau of Chemistry, Bull. 113, Injury to Vegetation and Animal Life by Smelter Wastes. Haywood.

Similar results were obtained with Kubanka in South Dakota, California, and Kansas, and for the years 1906, 1907, and 1908.

On the other hand, when seeds varying in physical and chemical characteristics, as shown in above table, were grown the following year side by side in Kansas, each plat gave a crop identical in composition and in physical appearance. When the same seeds were grown in Texas, the three plats again gave a crop of wheat identical in all respects, though quite different from the Kansas crop. The same was true of both kinds of wheat, and of each station at which the samples were grown.

These results show how little influence both seed and soil have on the composition and physical appearance of the succeeding crop. The differences in composition and physical appearance are due for the most part to the varying climatic conditions prevailing at each station during the growing period. The practice of getting seed which has been bred in a certain locality in order to grow it in another locality of different climatic condition is not to be commended, as the yield is not, thereby, greater than that of the home seed, nor is the composition improved in any way. The lesson to be learned from these experiments appears to be that wheat crops should be improved by selection or otherwise in the locality in which they are to be grown.

CORN.

The completion of a four years' experiment on the effect of environment on the composition of sweet corn has shown that in the localities observed along the Atlantic seaboard (Maine, Connecticut, Maryland, South Carolina, and Florida), a less marked effect is produced on sugar content by temperature than was the case in the similar studies made on the sugar beet, and, moreover, what influence is indicated is of the opposite character. The five years' experiment with the beet showed very decisively that its sugar content varied directly with the latitude and inversely with the temperature within reasonable limits. In the case of the corn, however, the southern latitudes having the higher temperatures gave the higher sugar content, this being especially marked in the case of the South Carolina station, where a high altitude gave an additional advantage. At this point the Crosby corn produced the highest percentage of sugar for each of the four years, being practically the same as the Maine crop in 1906, to which locality this variety is supposed to be especially adapted, and for two years the Stowells Evergreen was also the highest in sugar in South Carolina. While the average of total sugars for the whole experiment for Maine is practically the same as for South Carolina, the data for Florida and Maryland outrank those for Connecticut. It must be remembered also that only the Crosby corn could be grown in Maine, owing to the shortness of the season, and this variety is supposed to be characterized by a higher sugar content. It is to be noted in this connection that the kernels of the southern corn do not present the same physical appearance as that of the northern corn, both the germ and the kernel being larger in the former. Furthermore, the corn does not make so vigorous a growth either in Florida or in South Carolina as it does in Connecticut, though it seems to be as strong as the Maine corn: and, again, the Maryland corn was much more vigorous than that grown in Florida, South Carolina, or Maine, but did not appear to equal the Connecticut crop in size of stalk.

An interesting point developed was the close relation existing between the amount and more especially the distribution of the rainfall in connection with the sugar content. A moderate, well-distributed rainfall is absolutely essential to the storage of sugars, excessive rains, especially in the latter part of the growing period, being especially disastrous, as is well shown in 1906, when heavy rains along the Atlantic coast plainly accounted for the low sugar content at all stations in that year.

While these data are not as decisive and therefore are less valuable than those obtained for the sugar beet, they open up several interesting possibilities, among them that of greatly improving the Southern-grown product, since the superiority in sugar content is established. This work is in the hands of the Bureau of Plant Industry, in cooperation with which Bureau this experiment was made.

Another point established in the course of the experiment was that the content of sugar in sweet Indian corn rapidly diminishes after the ear is separated from the stalk; and that the speed of diminution depends largely on the temperature, being more rapid at a higher and slower at a lower temperature. Corn for the table should, therefore, be harvested as short a time as possible before being delivered and kept at a temperature slightly above freezing in the intermediate period.

Control of Supplies Purchased on Contract.

The principal progress made in this work has been in the large increase in the number of supplies examined, rather than in any especially new lines of work. This is especially the case with tests for the Isthmian Canal Commission, which alone

now amount to more than was done in this Bureau a few years ago in all branches of Federal contract work together. Chemical analyses and physical tests are often absolutely necessary to control the purchase of such supplies and insure delivery according to contract. A concrete example will probably best illustrate this point and its economic significance. An alloy of the following composition was ordered: Lead, 52 per cent; antimony, 4 per cent; tin, 44 per cent. The shipments as delivered were sampled and found to run as follows: Lead, from 88 to 93 per cent; antimony, from 1 to 11 per cent; and tin, from 1 to 14 per cent. After several consignments had been rejected the contractor found he could deliver goods in accordance with the specification. When it is remembered that lead is quoted at 4 cents per pound, antimony at 7½ cents, and tin at 28 cents, the loss involved in the shortage of tin and the presence of an excess of lead of over 40 per cent is a matter involving thousands of dollars. In such a case as this the first delivery submitted should be absolutely rejected, but sometimes the matter can be corrected in another way. For example, a sample of soap was submitted and the contract awarded. The soap delivered was similar in composition to the sample, except that it contained much more water, and, therefore, less soap. It was a simple matter to calculate that 117 pounds of the soap furnished was equal to 100 pounds of the sample submitted and a settlement was made on that basis.

While injustice of methods and results is sometimes claimed, it is by no means common, as is illustrated by the following occurrence: A contractor delivered an oil which he had tested, but it was rejected by the Contracts Laboratory. An explanation followed, and when shown that he was using a tester which was inaccurate, the matter was amicably and fairly adjusted and the contractor was able to prevent any future trouble with his shipments.

The testing of materials is, of course, an almost unlimited subject, but the samples submitted by the Isthmian Canal Commission alone give some idea of the scope of the work. Among the materials tested are the following: Paints, oils, varnishes, lubricants, chemicals, soaps, alloys, iron, steel, and boiler compounds. A similar line of work is conducted for the Bureau of Engraving and Printing.

Work in the Leather and Paper Laboratory.

This work has demonstrated that the draft on the forests for paper-making materials may be lessened, both by a larger use of other materials and wastes, and by making a better and lighter paper. The importance, from the standpoint of permanence, as well as economy, of using paper in every way especially adapted to the purpose for which it is intended, has been demonstrated, and specifications which will insure the delivery of such papers have been prepared (Departmental Report No. 89, entitled "Durability and Economy in Papers for Permanent Records").

The quality and value of leather is often greatly injured by incorrect operations during tanning and by the addition of foreign material primarily used for increasing weight. The investigations now in progress are showing how the quality of leather may be improved and its usefulness prolonged.

A most excellent method has been developed for detecting mineral oils in turpentine, and it has been shown that turpentine is frequently adulterated by such additions. This advance in the methods will enable purchasers to insure themselves of the delivery of pure turpentine when such is necessary for special purposes, such as for medicinal mixtures and high grade varnishes. Experiments on refining wood turpentine have also demonstrated that the quality of this product can be greatly improved, its technical applications broadened, and its value increased.

The economic importance of all of these investigations is far-reaching, and while the work must of necessity move slowly and the resultant commercial changes take place very gradually, their value to both consumer and producer is obvious.

AREAS SURVEYED AND MAPPED BY THE BUREAU OF SOILS.

By A. G. Rice, *Chief Clerk, Bureau of Soils.*

The following statement shows the location and extent of soil surveys made up to December 31, 1908. The Bureau prepares and issues a lithograph map, drawn on a scale of 1 mile to the inch for detailed surveys and 4 and 6 miles to the inch for reconnoissance surveys, for each area surveyed, indicating in colors the distribution of the various soils. The accompanying sketch map (fig. 29) gives the locations of these areas.

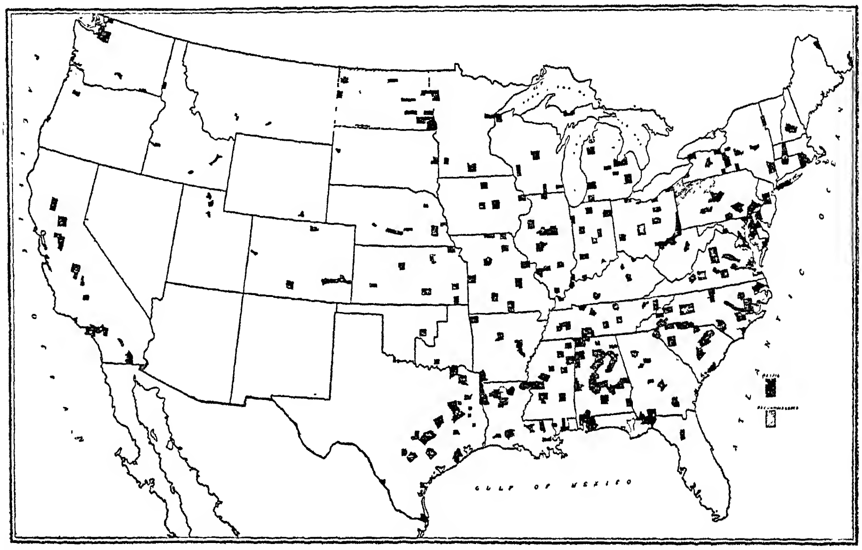


Fig. 29.—Location of areas surveyed by the Bureau of Soils. Shaded areas=reconnoissance surveys; black areas=detailed surveys.

The following statement gives a list of the areas surveyed, with the number of square miles in each and the total area surveyed in each State and Territory. The total for the United States is 215,345 square miles, or 137,820,800 acres.

Areas of soil surveys in the United States to December 31, 1908.

DETAILED SURVEYS.

	Square miles.	
Alabama:		
Autauga County	640	
Bibb County	625	
Blount County	625	
Butler County	771	
Calhoun County	621	
Colbert County	581	
Cullman County	741	
Dallas County	992	
Etowah County	533	
Fort Payne area	509	
Henry County	570	
Huntsville area	506	
Jefferson County	1,059	
Lamar County	611	
Lee County	629	
Lauderdale County	708	
Macon County	621	
Marion County	739	
Mobile area	461	
Montgomery County	780	
Perry County	762	
Sumter County	893	
Talladega County	750	
		15,727
Arizona:		
Salt River Valley area	449	
Solomonsville area	108	
Yuma area	340	
		897

DETAILED SURVEYS—continued.

	Square miles.	
Arkansas:		
Conway County	575	
Fayetteville area	569	
Miller County	626	
Prairie County	656	
Stuttgart area	251	
		2,677
California:		
Bakersfield area	195	
Colusa area	756	
Fresno area	628	
Hanford area	216	
Imperial area	1,084	
Indio area	234	
Los Angeles area	570	
Modesto-Turlock area	808	
Pajaro area	108	
Portersville area	329	
Redding area	200	
Sacramento area	924	
Salinas Valley area	344	
San Bernardino area	755	
San Gabriel area	259	
San Jose area	313	
Santa Ana area	275	
Stockton area	521	
Ventura area	240	
		8,759

Areas of soil surveys in the United States to December 31, 1908—Continued.

DETAILED SURVEYS—continued.

	Square miles.	
Colorado:		
Arkansas Valley area	945	
Grand Junction area	168	
Greeley area	687	
San Luis area	628	
		2,428
Connecticut:		
Connecticut Valley		506
Delaware:		
Dover area		314
Florida:		
Escambia County	662	
Gadsden County	548	
Gainesville area	485	
Jefferson County	585	
Leon County	675	
		2,955
Georgia:		
Bainbridge area	364	
Cobb County	346	
Covington area	225	
Dodge County	489	
Fort Valley area	186	
Grady County	460	
Spalding County	205	
Thomas County	540	
Waycross area	609	
		3,424
Idaho:		
Boise area	399	
Blackfoot area	428	
Lewiston area	308	
Minidoka area	146	
		1,281
Illinois:		
Clay County	460	
Clinton County	491	
Johnson County	339	
Knox County	717	
McLean County	1,159	
O'Fallon area	68	
Sangamon County	866	
St. Clair County	650	
Tazewell County	645	
Winnebago County	526	
		5,921
Indiana:		
Allen County	667	
Boonville area	264	
Greene County	535	
Madison County	435	
Marion County	389	
Marshall County	445	
Newton County	393	
Posey County	387	
Scott County	197	
Tippecanoe County	499	
		4,211
Iowa:		
Cerro Gordo County	567	
Dubuque area	440	
Story County	576	
Tama County	720	
		2,303
Kansas:		
Allen County	504	
Brown County	573	
Garden City area	335	
Parsons area	398	
Riley County	634	
Russell area	270	
Wichita area	465	
		3,179
Kentucky:		
McCracken County	242	
Madison County	437	
Mason County	225	
Scott County	280	
Union County	361	
Warren County	533	
		2,078
Louisiana:		
Acadia Parish	636	
Bienville Parish	812	
Caddo Parish	898	
De Soto Parish	825	

DETAILED SURVEYS—continued.

	Square miles.	
Louisiana—Continued.		
East and West Carroll parishes	727	
East Baton Rouge Parish	451	
Lake Charles area	202	
New Orleans area	410	
Ouachita Parish	605	
Tangipahoa Parish	788	
Winn Parish	960	
		7,314
Maine:		
Aroostook area		500
Maryland:		
Calvert County	217	
Cecil County	376	
Easton area	966	
Harford County	418	
Kent County	293	
Prince George County	480	
St. Mary County	363	
Worcester County	463	
		3,576
Massachusetts:		
Connecticut Valley		809
Michigan:		
Allegan County	828	
Alma area	282	
Cass County	500	
Munising area	407	
Oxford area	210	
Owosso area	270	
Pontiac area	307	
Saginaw area	984	
Wexford County	572	
		4,360
Minnesota:		
Blue Earth County	749	
Carlton area	413	
Crookston area	779	
Marshall area	233	
		2,174
Mississippi:		
Biloxi area	615	
Crystal Springs area	231	
Holmes County	820	
Jackson area	737	
Jasper County	675	
McNeill area	198	
Monroe County	761	
Montgomery County	405	
Oktibbeha County	446	
Pontotoc County	498	
Prentiss County	415	
Smedes area	463	
Yazoo area	656	
		6,920
Missouri:		
Bates County	874	
Crawford County	747	
Howell County	919	
O'Fallon area	552	
Putnam County	523	
Saline County	748	
Scotland County	440	
Shelby County	511	
Webster County	605	
		5,919
Montana:		
Billings area	107	
Gallatin Valley area	325	
		432
Nebraska:		
Grand Island area	446	
Kearney area	792	
Lancaster County	857	
North Platte area	470	
Sarpy County	227	
Stanton area	323	
		3,115
New Hampshire:		
Merrimack County		923
New Jersey:		
Salem area	493	
Trenton area	810	
		1,303
New Mexico:		
Pecos Valley area		128

Areas of soil surveys in the United States to December 31, 1908—Continued.

DETAILED SURVEYS—continued.

	Square miles.	
New York:		
Auburn area	461	
Bigflats area	223	
Binghamton area	229	
Dutchess County	800	
Livingston County	629	
Long Island area	845	
Lyons area	515	
Madison County	649	
Montgomery County	405	
Niagara County	547	
Syracuse area	416	
Tompkins County	493	
Vergennes area	160	
Westfield area	260	
		6,632
North Carolina:		
Alamance County	365	
Asheville area	497	
Cary area	63	
Caswell County	396	
Chowan County	178	
Craven area	897	
Duplin County	824	
Edgecombe County	515	
Henderson County	366	
Hickory area	988	
Mount Mitchell area	497	
New Hanover County	192	
Parmele area	236	
Perquimans and Pasquotank counties	461	
Raleigh to Newbern area	718	
Robeson County	1,058	
Statesville area	784	
Transylvania County	372	
		9,407
North Dakota:		
Cando area	283	
Carrington area	720	
Fargo area	406	
Grand Forks area	314	
Jamestown area	496	
McKenzie area	348	
Morton area	544	
Ransom County	856	
Richland County	1,453	
Williston area	585	
		6,005
Ohio:		
Ashtabula area	340	
Cleveland area	509	
Columbus area	472	
Coshocton County	551	
Meigs County	443	
Montgomery County	480	
Toledo area	403	
Westerville area	476	
Wooster area	469	
		4,143
Oklahoma:		
Oklahoma County	720	
Tishomingo area	443	
		1,163
Oregon:		
Baker City area	158	
Klamath Falls project	249	
Salem area	284	
		691
Pennsylvania:		
Adams County	534	
Center County	1,150	
Chester County	760	
Johnstown area	714	
Lancaster area	269	
Lebanon area	669	
Lockhaven area	278	
Montgomery County	496	
		4,870
Porto Rico:		
Arecibo to Ponce		330
Rhode Island:		
State		1,085
South Carolina:		
Abbeville area	1,006	
South Carolina—Continued.		
Campobello area	515	
Charleston area	352	
Cherokee County	361	
Darlington area	599	
Lancaster County	486	
Lee County	411	
Oconee County	652	
Orangeburg area	709	
Sumter County	587	
York County	669	
		6,347
South Dakota:		
Belle Fourche area	190	
Brookings area	484	
		674
Tennessee:		
Clarksville area	547	
Coffee County	442	
Davidson County	501	
Giles County	614	
Grainger County	307	
Greeneville area	664	
Henderson County	499	
Lawrence County	618	
Madison County	561	
Overton County	433	
Pikeville area	440	
		5,626
Texas:		
Anderson County	1,069	
Austin area	705	
Bastrop County	917	
Brazoria area	845	
Brownsville area	189	
Camp County	200	
Cooper area	625	
Corpus Christi area	363	
Franklin County	292	
Henderson area	581	
Houston County	1,192	
Jacksonville area	100	
Lavaca County	995	
Laredo area	155	
Lee County	666	
Lufkin area	99	
Nacogdoches area	97	
Paris area	548	
Robertson County	852	
San Antonio area	484	
San Marcos area	515	
Vernon area	277	
Waco area	495	
Willis area	215	
Wilson County	783	
Woodville area	100	
		13,359
Utah:		
Bear River area	334	
Provo area	373	
Salt Lake Valley area	249	
Sevier Valley	235	
Weber County	310	
		1,501
Vermont:		
Vergennes area		227
Virginia:		
Albemarle area	1,410	
Appomattox County	340	
Bedford area	632	
Chesterfield County	478	
Hanover County	475	
Leesburg area	419	
Louisa County	505	
Montgomery County	393	
Norfolk area	303	
Prince Edward area	430	
Yorktown area	598	
		5,983
Washington:		
Bellingham area	384	
Everett area	525	
Island County	233	
Walla Walla area	201	
Yakima area	309	
		1,652

Areas of soil surveys in the United States to December 31, 1908—Continued.

DETAILED SURVEYS—continued.

	Square miles.	
West Virginia:		
Middlebourne area	952	
Parkersburg area	975	
Upshur County	330	
Wheeling area	315	
		2,572
Wisconsin:		
Janesville area	451	
Portage County	797	
Racine County	326	
Superior area	482	
Viroqua area	504	
		2,560
Wyoming:		
Laramie area		309
Total		169,269

RECONNOISSANCE SURVEYS.

	Square miles.
Appalachian:	
Northwestern Pennsylvania	8,112
Great Plains:	
Western North Dakota	39,464
Total	47,576
Grand total of detailed and reconnoissance, less overlapping areas	215,368

THE PRINCIPAL INJURIOUS INSECTS OF THE YEAR 1908.

Prepared in the Bureau of Entomology.

INSECTS INJURIOUS TO COTTON AND OTHER SOUTHERN FIELD CROPS.

The cotton boll weevil (*Anthonomus grandis* Boh.) extended its range to an unusual extent in 1908. The extension was particularly marked in the State of Mississippi. At present the territory invaded covers practically all of Texas except the western cotton-producing area, all of Louisiana except the southwestern counties, 18 counties in Mississippi, 28 in Arkansas, and about one-fifth of the State of Oklahoma. As regards damage during 1908 the situation was peculiar. In Texas the damage was far below the normal; in Louisiana it was about normal. The situation in Texas is explained by climatic conditions of the fall of 1907 and the following winter, as well as during the growing season of the crop of 1908. An unusually small percentage of weevils survived the winter—only about one-fourth as many as survived to damage the cotton in 1907. As a consequence, in August only 5 per cent of the squares were infested as against 54 per cent in August, 1907.

In Louisiana no conditions occurred to check the weevil in 1908. As many as 6,000 hibernated individuals per acre were found to have made their way to cotton fields in certain parishes. The damage in the State was complicated by extensive overflows. Making due allowance for such other factors as conduced to the reduction of the crop, it is estimated that the boll weevil destroyed about 400,000 bales in the whole infested territory. This represents a value of about $20,000,000. The greater part of this loss was in Louisiana, eastern Texas, and a small infested area in Mississippi. In central and western Texas the crop was in many respects about normal.

The cotton bollworm (*Heliothis obsoleta* Fab.) in general was not as injurious as in 1907. However, there was an extensive area in northwestern Texas where great damage was done. In fact, in this quarter the injury from the bollworm was much greater than from the boll weevil. As an enemy of corn and other crops this insect was not especially noticeable.

The cotton square borer (*Uranotes melinus* Hbn.) attracted less attention than usual throughout the cotton belt. There were some localities of special damage, but no general injury was recorded.

The cotton aphis (*Aphis gossypii* Glov.) occurred in much less than the usual numbers on account of a dry spring.

The garden webworm (*Loxostege similalis* Guen.) was unusually abundant. In fact, damage by this insect was one of the features of the year in Texas and Louisiana. Many fields of cotton were destroyed by insects that made their way from alfalfa fields after cutting.

The cotton leaf caterpillar (*Alabama argillacea* Hbn.) occurred in about the normal numbers.

Cutworms injuring cotton were unusually scarce throughout the cotton region.

The sugar-cane borer (*Diatræa saccharalis* Fab.) accomplished the normal amount of damage in Louisiana. In southern Texas, where the sugar industry is developing rapidly, this pest has assumed great importance. In the Brownsville region the damage in 1908 was far more extensive than ever before.

Damage to the rice crop by a number of species of insects which suck out the juice of the heads was reported in Louisiana and Texas.

Cactus is rapidly becoming an important farm crop in western Texas and elsewhere. A number of insects constitute an important obstacle in planting. The most important is *Chelinidea vittigera* Say, which occurs in great numbers wherever

cactus is cultivated. Next in importance is *Narnia pallidicornis* Reut. About four-fifths of the total damage done by insects to cactus is to be charged to these two species. They were probably not more numerous in 1908 than in other years, but their damage has only recently come to attention on account of the very recent establishment of cactus as a farm crop.

The tobacco thrips (*Euthrips nicotianæ* Hinds) occasioned very severe loss to growers of shade tobacco in Florida. Individual losses reached $10,000 and even $20,000.

The tobacco splitworm (*Phthorimæa operculella* Zell.) was very injurious in some sections of Florida. One grower at Dade City estimated his loss at $15,000.

The tobacco budworm (*Chloridea virescens* Fab.) caused considerable loss to growers of shade tobacco in Florida and Georgia.

The tobacco stalk-borer (*Crambus?* sp.) caused a loss of approximately $800,000 to Virginia growers.

The tobacco flea-beetle (*Epitrix parvula* Fab.) was not so injurious as in previous years, yet the injury done was considerable.

The tobacco hornworms (*Phlegethontius quinquemaculata* Haw. and *P. sexta* Joh.) caused much less damage than in 1907 in Kentucky and Tennessee, although the loss was more than $100,000. The injury in other States was not very appreciably less than in previous years.

The following species were found damaging tobacco to a slight extent in the dark-tobacco region: Two grasshoppers (*Melanoplus atlanis* Riley, *M. differentialis* Thos.), a tree cricket (*Œcanthus quadripunctatus* Beut.), the bollworm (*Heliothis obsoleta* Fab.), and two cutworms (*Agrotis ypsilon* Rott., and *Peridroma margaritosa* Haw.). Of these the last two species occasioned the greatest damage.

Insects Affecting Cereal and Forage Crops.

A serious outbreak of the chinch bug (*Blissus leucopterus* Say) was threatened throughout northern Texas, Oklahoma, and southern Kansas in early spring, but frequent rains over the entire territory during the hatching season prevented serious damage. By midsummer the pest had nearly disappeared. The only report of serious injury was at Brooklyn, N. Y., by the short-winged form destroying grass on lawns.

The threatened outbreak of the Hessian fly (*Mayetiola destructor* Say) in Kansas and extreme northern and central Oklahoma materialized in the spring and the grain in the principal wheat-growing section of Kansas was badly injured, some of it being a total loss and left unharvested in the fields. Almost no damage whatever occurred south of the Arkansas River, and the pest did not occur, even in limited numbers, farther south than El Reno, in Oklahoma. Following the information secured from experimental wheat sowings in 1907 and 1908, the seeding of 1908 was delayed all over the infested territory and as a consequence went into the winter uninjured by the Hessian fly. The only danger that threatens the crop in the spring of 1909 is in its occurrence in volunteer wheat, which, owing to the wet weather, sprang up everywhere in the fields during September and October. The pest, in cases of excessive abundance, attacked quack grass (*Agropyron smithii*), eggs having been observed in great abundance on the blades, and adult flies were reared therefrom. The only additional reports of injury came from western Oregon, although the insect is known to have been abundant in early sown fields in eastern Ohio.

A flea-beetle, *Chætocnema ectypa* Horn, attacked young grain in southern New Mexico in April. The same pest also worked considerable injury to young Kafir corn.

The wheat-stem maggot (*Meromyza pratorum* Meig.) was reared from young wheat in southern New Mexico, and adult insects captured throughout the country northward into Colorado, Wyoming, and central Montana. It seems likely that the insect breeds principally in wild grass.

The wheat joint-worm (*Isosoma tritici* Fitch) occurred in destructive abundance and in some cases worked serious injury throughout western West Virginia, Ohio, Indiana, and southern Illinois. Wheat was not attacked west of the Mississippi River.

The larvæ of the wheat straw-worm (*Isosoma grande* Riley), which usually does comparatively little injury east of the Mississippi River, were excessively abundant in Kansas and some portions of southern Nebraska and northern Oklahoma. The greatest damage caused by this insect was in eastern and southern Washington and the bordering portion of Oregon. Throughout this section some fields of wheat were totally destroyed.

The timothy joint-worm (*Isosoma* sp.) continues to occur in increasing abundance over the country east of the Great Plains wherever timothy is grown as a forage crop.

The spring grain-aphis (*Toxoptera graminum* Rond.), although not reported as destructive in any section of the country, was present in sufficient numbers to do slight injury in some sections, notably southeastern New Mexico. Over the entire

range of country from extreme southern Texas and New Mexico to eastern Washington, and eastward to Pennsylvania and New Jersey, the so-called "green bug" occurred sparingly, but in sufficient numbers to show that only one or at most two favorable seasons are required to precipitate another disastrous invasion. It is not confined to grain fields, but throughout the section indicated, where bluegrass is indigenous, it may be found in the milder seasons of the year in greater or less numbers. It has also been found in various parts of the country breeding on the following grasses: *Alopecurus geniculatus*, *Agropyron occidentalis*, *Agropyron tenerum*, *Bromus porteri*, *Bromus secalinus*, *Dactylis glomerata*, *Distichlis spicata*, *Eleusine indica*, *Eragrostis pilosa*, *Eragrostis megastachya*, *Elymus striatus*, *Elymus virginicus*, *Elymus canadensis*, *Hordeum pusillum*, *Hordeum jubatum*, *Hordeum cæspitosum*, *Poa pratensis*, *Polypogon monspeliensis*, *Sporobolus neglectus*, and *Stipa viridula*. This shows that it may continue to exist in the country regardless of the growing of wheat or oats. Parasites that are known to attack and destroy it also breed freely in insects on cabbage, corn, cotton, rose, apple, and several of the native grasses.

A blister beetle (*Cantharis nuttalli* Say) was received as destroying alfalfa in North Dakota. Outbreaks of a closely related species were reported from western Texas.

The clover-seed chalcis (*Bruchophagus funebris* How.) was reported destructive to alfalfa seed in New Mexico, California, Colorado, and Kansas. It was also received, during the year, with alfalfa seed from Chile, South America; from Omsk, Siberia, and from northern Turkestan. The same species is destructive to red clover in the United States wherever the latter is grown for seed.

The western twelve-spotted Diabrotica (*Diabrotica soror* Lec.) was reported destructive to alfalfa in California.

Different species of grasshoppers attacked alfalfa in California, Oregon, Washington, Idaho, Wyoming, and New Mexico. Outbreaks of these insects among other crops were reported from Arkansas, Minnesota, Michigan, Ohio, Alabama, New Jersey, New York, and Maine.

The garden webworm (*Loxostege similalis* L.) was reported from various points in Texas.

An outbreak of *Phytonomus murinus* Fab., a new alfalfa insect, was reported as having occurred about Salt Lake City, Utah.

The clover aphis (*Callipterus trifolii* Monell) was reported as affecting red clover in South Carolina, Tennessee, and Kansas.

A new enemy, probably the larva of one of the leaf-eating beetles, was found destroying the roots of clover at Fulton, Ky. The insect has not yet been reared, and hence can not be identified.

The clover-seed midge (*Dasyneura leguminicola* Lintn.) was reported as injuring clover in Maryland, Indiana, Ohio, and Canada.

The clover root-borer (*Hylastinus obscurus* Marsh.) was reported as having been very destructive at points in Ohio and about Vancouver, Wash.

The clover-leaf weevil (*Phytonomus punctatus* Fab.) was reported from points east of the Mississippi River, especially in Virginia and Maryland.

The lesser clover-leaf weevil (*Phytonomus nigrirostris* Fab.) is becoming more and more abundant in the southern Atlantic States.

Sitones hispidulus Germ., a weevil, was found to attack clover in the vicinity of the District of Columbia.

There was a serious outbreak of crane-fly larvæ (*Tipula infuscata* Loew) among clover at Jackson, Tenn., the larvæ, or maggots, destroying the roots. A similar outbreak of these or similar insects was reported from clover fields at Mount Vernon, Ind.

Wireworms were reported very destructive on lowlands about New London, Ohio.

A serious outbreak of a cutworm (*Agrotis ypsilon* Rott.) occurred in the Wabash and Ohio bottoms about Mount Vernon, Ind., and adjacent portions of Kentucky and Illinois. The pest destroyed hundreds of acres of corn throughout this territory, causing an estimated damage of $200,000. The same species did serious damage about New Paris, Ohio.

The slender seed-corn beetle (*Clivina impressifrons* Lec.) continued to injure corn in some sections of Ohio, notably about New Paris.

The southern corn root-worm (*Diabrotica 12-punctata* Oliv.) was reported destructive to corn in North Carolina, Mississippi, and Texas.

The western corn root-worm (*Diabrotica longicornis* Say) was reported destroying corn in Indiana and southern Ohio.

The larger corn stalk-borer (*Diatræa saccharalis* Fab.) did considerable damage in southern Virginia and North and South Carolina.

The corn-ear worm (*Heliothis obsoleta* Fab.) was reported as damaging corn in fields in Virginia, Nebraska, Missouri, Texas, New Mexico, Arizona, Oklahoma, Kansas, Wyoming, and Minnesota, and as attacking the heads of sorghum in Georgia and Arkansas.

Damage by white grubs (*Lachnosterna* spp.) was reported from Martinsville, Ind., Mendon, Mich., and parts of Kansas.

The elephant bug (*Lixus mucidus* Lec.) was reported as destroying corn in the neighborhood of Kaw City, Kans.

A cutworm, *Prodenia ornithogalli* Guen., damaged corn in early June in South Carolina.

A common billbug, *Sphenophorus cariosus* Oliv., was found destroying corn in South Carolina.

The adults of *Diabrotica balteata* Lec. fed upon the leaves of young corn at Mercedes, Tex., in the spring.

The sorghum midge (*Contarinia sorghicola* Coq.), a minute insect, destroyed the seed of sweet sorghum in the Gulf States. It has been reared from sorghum seed from North Carolina to central Texas, and north to northern Kansas. So far it has not been observed west of the one hundredth meridian.

Nigetia sorghiella Riley breeds in the heads of sorghum from Virginia to San Antonio, Tex.

A thrips, *Limothrips avenæ* Hinds, injured unripe grains of oats in Maryland.

The larva of a fly, *Ceratomyza dorsalis* Loew, destroyed young rye in Georgia in April.

A small beetle, *Mordellistena ustulata* Lec., breeds in the lower part of the stems of timothy, from which adults have been reared in Indiana, Ohio, and Tennessee.

The larva of a beetle, *Eleodes* sp., destroyed growing wheat in Kansas in October.

The corn leaf-aphis (*Aphis maidis* Fitch) attacked fall-sown barley in late fall and early winter in South Carolina, and the winter was passed by the insect on the plants in the field.

The larvæ of a crane fly (*Tipula simplex* Doane) were very destructive to grass and growing grain in California, reports having been received of serious damage, mostly confined to the central portion of the State.

The cattle ranges of northeastern New Mexico are being seriously ravaged by the caterpillar of a large moth (*Hemileuca hualapai* Neum.). The most serious damage is being done between Springer, Raton, and the Rocky Mountains. Over whole square miles the grass was eaten and the ground left as bare as though burned over by fire.

The cowpea-pod weevil (*Chalcodermus æneus* Boh.) attacks and destroys peas in the pods. The egg is deposited in a small cavity made in the pod and the young larva makes its way to the unripe pea and destroys it. On becoming full grown it descends to the ground and transforms to the adult insect.

The common white ant (*Termes flavipes* Koll.) was observed attacking cowpeas in patches in South Carolina.

Considerable injury was done to cowpeas in Indiana by a red mite (*Tetranychus bimaculatus* Harv.).

A thrips attacked young leaves of cowpea and did some injury in Virginia.

Insects Injurious to Truck Crops.

Of insects injurious during the calendar year 1908 aphides were prominent, and among these, the pea, spinach, and cabbage aphides were most destructive; the imported pea moth made its first destructive appearance in the United States; the hop flea-beetle has become a pest of great importance in British Columbia near the United States boundary line; and the horse-radish flea-beetle, an imported species, has just become a pest in America. The melon and pickle worms were unusually destructive, and the strawberry weevil caused serious losses in North Carolina.

The common asparagus beetle (*Crioceris asparagi* L.) was one of the most injurious insects of the season. Complaints were received from portions of Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Michigan, Maryland, Virginia, and the District of Columbia, and the species was ascertained to be permanently located in new localities in California. It was particularly troublesome in Maryland.

The asparagus miner (*Agromyza simplex* Loew) was exceedingly destructive in eastern Massachusetts and less so in the vicinities of the District of Columbia and of Portsmouth, Va.

Bean and pea weevils were frequently reported in importations from abroad. Seed cowpeas were less injured about Norfolk and northward than in many previous years. Many complaints of the bean weevil (*Bruchus obtectus* Say) were received from New York westward to Wisconsin and Nebraska and southward to South Carolina, Arkansas, and Texas. The pea weevil (*Bruchus pisorum* L.) was especially bad in both Michigan and Connecticut. Many inquiries were made for better remedies for this class of pests.

The bean aphis (*Aphis rumicis* L.) caused injury to beans in Massachusetts and Wisconsin; to celery, horse radish, and strawberries in California; and to rhubarb, beets, and broad beans in New Jersey.

The bean leaf-beetle (*Cerotoma trifurcata* Forst.) was very injurious to Lima and string beans in different localities in New York, New Jersey, Virginia, and the District of Columbia.

The pea aphis (*Macrosiphum pisi* Kalt.) was more injurious than for many seasons. Complaints were made of ravages in New York, and especially on Long Island, in Maryland, Virginia, and Pennsylvania, extending to Canada and California. In New Hampshire early peas were destroyed, while in the Norfolk region injury was to late peas.

The imported pea moth (*Enarmonia* [*Semasia*] *nigricana* Steph.) was injurious to peas at Charlevoix, Mich., this being the first record of injury in the United States.

The sugar-beet webworm (*Loxostege sticticalis* L.) was injurious in the vicinity of Longmont and Denver, Colo., and Hamilton City, Cal.

The southern beet webworm (*Pachyzancla bipunctalis* Fab.) was observed injuring beets and spinach in southern Texas.

The beet army worm (*Caradrina exigua* Hbn.) came under observation as a pest on sugar beet, alfalfa, and peas in California; it also did injury to eucalyptus. In Utah it was injurious to sugar beet.

The hop flea-beetle (*Psylliodes punctulata* Melsh.), a common beet pest, was more injurious than before reported. In British Columbia injury extended to near the United States boundary line, hop-growers suffering a cash loss estimated at $125,000 in the Chilliwack and Agassiz Valley region alone.

The zebra caterpillar (*Mamestra picta* Harr.) was injurious to sugar beet and various truck crops in portions of California, as also in Wisconsin and Illinois.

The pale-striped flea-beetle (*Systena blanda* Melsh.) did considerable damage to sugar beets in southern California.

A flea-beetle, *Chætocnema ectypa* Horn, was observed attacking cantaloupe, but was more abundant on corn and other cereals. It was also found and collected in some numbers on sugar beet, and when abundant it is evidently a somewhat general feeder. Its range extends from California to Texas.

A tenebrionid beetle, *Blapstinus brevicollis* Lec., with related species, was the subject of complaint from sugar-beet growers in portions of California and Colorado, and was also found attacking horse radish, grapes, and dried fruits in California.

The beet leaf-miner (*Pegomya vicina* Lintn.) was quite abundant on sugar and table beets and spinach generally throughout southern California.

The flavescent leafhopper (*Empoasca flavescens* Fab.) was injurious to sugar beet in California. Elsewhere it appeared unusually rare.

The beet root-aphis (*Tychea brevicornis* Hart) was abundant at the roots of lettuce in northern New Jersey and came under observation on the roots of mustard in southern California.

The imported cabbage worm (*Pontia rapæ* L.) was locally troublesome from Maine to New York, westward to California, and southward to Tennessee.

The cabbage looper (*Autographa brassicæ* Riley) was more abundant and injurious than for several seasons in certain localities. It did the usual amount of damage to cabbage and other cole crops in the truck-growing regions of Virginia, Tennessee, South Carolina, and Florida. It was also injurious to spinach and lettuce in Texas, and was moderately injurious on spinach and lettuce in other regions, including portions of Maryland, Virginia, and California.

The imported cabbage webworm (*Hellula undalis* Fab.) was noticed in southern California, southern Texas, and Mississippi.

The diamond-back moth (*Plutella maculipennis* Curt.) attracted more attention than for many years, injury being chiefly to cabbage in Georgia, Florida, Texas, New Mexico, Virginia, Tennessee, New York, and California.

The cross-striped cabbage worm (*Evergestis rimosalis* Guen.) was injurious in Tennessee and Virginia.

The cabbage aphis (*Aphis brassicæ* L.) was one of the worst pests of the year. It was particularly destructive in the Norfolk trucking region, as elsewhere in Virginia, its range of destructiveness extending to Florida and Texas in the South and westward to southern California. It was also injurious northward in New York, New Jersey, Ohio, and Canada.

The cabbage or radish maggot (*Pegomya brassicæ* Bouché) was injurious in Massachusetts, New Jersey, Pennsylvania, Ohio, Indiana, Michigan, Iowa, Wisconsin, North Dakota, West Virginia, and Vermont. Some injury was reported in Canada.

The harlequin cabbage bug (*Murgantia histrionica* Hahn) was injurious locally in Virginia, and became more abundant near the District of Columbia than for many years. It was also the subject of complaint in Missouri, Alabama, and California.

The striped turnip flea-beetle (*Phyllotreta vittata* Fab.) was destructive to turnip, cabbage, or radish, according to the crop grown. in eastern Massachusetts, Pennsylvania, the District of Columbia, and Canada.

The western cabbage flea-beetle (*Phyllotreta pusilla* Horn) was very destructive to radish, turnip, cabbage, and some other truck crops in Oklahoma, Texas, and New Mexico. The related *Phyllotreta albionica* Lec., was associated with it in Texas.

The horse-radish flea-beetle (*Phyllotreta armoraciæ* Koch) was reported very injurious for the first time in America at Glencoe, Ill., in which State it has been established since 1893.

As 1908 was an "aphis year," the melon aphis (*Aphis gossypii* Glov.) was, with the cabbage aphis, one of the most troublesome of the season, injuries extending from Massachusetts southward to Florida and Texas and westward through Illinois, Michigan, and Iowa to California. Injury, as usual in aphis years, was particularly bad in Nebraska.

The striped cucumber beetle (*Diabrotica vittata* Fab.) was the subject of the usual complaints practically throughout the country.

The squash-vine borer (*Melittia satyriniformis* Hbn.) was more destructive than for several seasons, its ravages being particularly severe in Massachusetts, Connecticut, New York, New Jersey, and Illinois.

The squash bug (*Anasa tristis* De G.) was about normally injurious. Reports of injury were made from Connecticut westward through Pennsylvania, Ohio, Illinois, and Michigan to Wisconsin, and southward to New Jersey and Missouri.

The melon and pickle worms (*Diaphania* spp.) were unusually abundant and destructive to cucumbers and canteloupes in South Carolina, Georgia, Alabama, Mississippi, Arkansas, and Tennessee, but did not attract attention in their northern range.

The Colorado potato beetle (*Leptinotarsa 10-lineata* Say) was injurious locally. It was particularly troublesome in New York and Virginia and locally in New Jersey, Pennsylvania, Illinois, Mississippi, South Carolina, Missouri, Iowa, Wisconsin, Indiana, and Vermont.

The potato flea-beetle (*Epitrix cucumeris* Harr.) was a veritable pest in many regions. It was particularly abundant in New York, Pennsylvania, Maryland, Virginia, Illinois, Missouri, and Canada, attacking potato, tomato, and eggplant. Owing to dry weather the attacks of this species caused serious injury, the leaves of potato turning brown and dying. The eggplant flea-beetle (*Epitrix fuscula* Cr.) was injurious in Missouri, Illinois, Maryland, Virginia, and the District of Columbia. The tobacco flea-beetle (*Epitrix parvula* Fab.) was injurious to potatoes in Texas and California.

The potato tuber worm (*Phthorimæa operculella* Zell.) continues destructive in California.

The tomato worms (*Phlegethontius quinquemaculata* Haw. and *P. sexta* Joh.) were the subject of complaint in New Jersey, the District of Columbia, Missouri, and California.

The potato stalk weevil (*Trichobaris trinotata* Say) was troublesome in Pennsylvania, New Jersey, and in Virginia near the District of Columbia.

The sweet-potato root-borer or weevil (*Cylas formicarius* Fab.) was reported to do quite extensive injury in Louisiana and more moderate injury in Texas and Florida.

The garden webworm (*Loxostege similalis* Guen.) was destructive to lettuce at Norfolk, Va.

The onion thrips (*Thrips tabaci* Lind.) was very injurious to onion in Nebraska and generally in Texas, California, Florida, and for the first time in recent years in the District of Columbia and the Norfolk region of Virginia; it also injured hothouse cucumbers and other plants.

The onion maggot (*Pegomya cepetorum* Meade) was less injurious than in some other years, but was troublesome in parts of New Jersey, Pennsylvania, Indiana, and Illinois.

The seed-corn maggot (*Pegomya fusciceps* Zett.) was injurious to beans in Genesee County, Mich.; to lettuce in New Jersey; to beans and cabbage in the Norfolk, Va., region, and in Texas; and to beans in the Pacific coast region.

The spinach aphis or "green fly" (*Myzus persicae* Sulz. [*Rhopalosiphum dianthi* Schrank]), which came into prominence as a spinach pest in the trucking region of tidewater Virginia in 1907, continued on spinach until it was picked for shipment in February, 1908. Injury was very severe to this, one of the staple crops of that region, about 1,000 acres being affected. After picking, the species practically disappeared, but by the following October it became abundant on kale and, to a less extent, on cabbage near Portsmouth, Va. In other localities it was also injurious; in Texas to turnip, eggplant, and pepper. It also injuriously affected cabbage, potato, turnip, and other plants in the District of Columbia, both in the field and under glass; and it caused complaint because of its ravages on spinach on Long Island, potato at Watertown, N. Y., cabbage in Ohio, and sugar beet in Utah.

The western twelve-spotted cucumber beetle (*Diabrotica soror* Lec.) always a pest in the Pacific coast region, was injurious to melons, sugar beet, beans, potato, sweet corn, peanuts, and to various garden crops in California.

The common stalk borer (*Papaipema nitela* Gn.) was more injurious than during the two previous years to various vegetable and flower gardens in the District of Columbia, Virginia, Maryland, New Jersey, Pennsylvaina, and Ohio.

The green clover worm (*Plathypena scabra* Fab.) was injurious to beans and strawberries in the Norfolk region of Virginia, to strawberries in Maryland, and to beans in Massachusetts.

The celery or greenhouse leaf-tyer (*Phlyctænia ferrugalis* Hbn.) was troublesome as usual in greenhouses in the District of Columbia. It was destructive at Adrian, Mich.; to sweet pea, chrysanthemum, and carnations at Akron, N. Y.; to celery and lettuce in California; and to spinach in Texas.

Injury by the corn-ear worm (*Heliothis obsoleta* Fab.) was reported to sweet corn, beans, tomatoes, spinach, and ornamentals, chiefly on Long Island, in Texas, California, Alabama, Georgia, Maryland, Arkansas, Nebraska, and New Mexico. Nevertheless, this was scarcely a corn-ear worm year.

The tarnished plant-bug (*Lygus pratensis* L.) was injurious to Lima beans in Pennsylvania, to celery in Illinois, and to kale and chrysanthemum in the District of Columbia.

The corn delphax (*Peregrinus* [*Delphax*] *maidis* Ashm.) was injurious to sweet corn in southern Texas.

The viridescent leafhopper (*Empoasca viridescens* Walsh) continues to attract attention by its injuries to sugar beet, potato, sweet potato, celery, peanuts, and squash in California, to potato in New York, and to various truck crops in southern Texas.

The currant leafhopper (*Empoasca mali* Le B.) was injurious to potato and beans in New Jersey and to shade trees in the District of Columbia.

The garden flea-hopper (*Halticus uhleri* Giard) was more or less injurious to cucumber, squash, and beans in New Jersey; to beans in the District of Columbia, and to lettuce and sweet potato in the trucking region of Norfolk, Va.

The corn root-aphis (*Aphis maidi-radicis* Forbes) has apparently acquired new food habits, being reported during the year on pumpkin, cotton, orange, artichoke, strawberry, and ornamental composites. Injury extended from Rhode Island westward to Illinois and southward to Maryland, West Virginia, and North Carolina.

The changa (*Scapteriscus didactylus* Latr.), a mole-cricket, was destructive in portions of Georgia to turnips, cabbage, corn, and on lawns and to general crops.

The green plant-bug (*Nezara hilaris* Say) was injurious to Lima beans in the District of Columbia and Virginia, to cabbage in southern Louisiana, and to corn at Kirkland, Ariz.

Cutworms were more injurious locally than in some seasons, but no widespread outbreaks were reported. The variegated cutworm (*Peridroma margaritosa* Haw.) was moderately abundant in portions of Virginia and Texas. The black cutworm (*Agrotis ypsilon* Rott.) was injurious to cabbage, onions, and other truck crops in southern Texas.

The granulated cutworm (*Feltia annexa* Tr.) was injurious to various truck crops in Florida and in southern Texas. The shagreened cutworm (*Feltia malefida* Gn.) was injurious to potato and cabbage at Corpus Christi and Brownsville, Tex.

Blister beetles were hardly as injurious as in many previous years. The three-lined blister beetle (*Epicauta lemniscata* Fab.) was injurious to tomato and cabbage in Arkansas. The striped blister beetle (*E. vittata* Fab.) was troublesome on various truck crops in Maryland, Virginia, and the District of Columbia. The margined blister beetle (*E. marginata* Fab.) was abundant, doing particular damage to potato, tomato, cabbage, and pumpkin in portions of New Jersey, Virginia, Missouri, and Arkansas.

The past season was scarcely a white-grub year, yet a moderate number of injuries were reported. The larva of the rugose June beetle (*Lachnosterna rugosa* Mels.) was injurious to sugar beet, potato, and grass in Illinois What is probably the same species injured sugar beet in Michigan. Others were destructive to potato in North Carolina and Mississippi, to raspberry in the District of Columbia, to sugar beet and strawberry in California, to strawberry in Washington, to various truck and garden crops in Maine and Maryland, and to pecan in Florida.

Wireworms were exceedingly abundant and troublesome generally, from Vermont and Virginia westward through the northern tier of States to Washington and California. They were also the subject of complaint in Virginia, Texas, South Carolina, New Mexico, and Nova Scotia. They attacked all kinds of vegetables, including celery, beans, sugar beet, potato, lettuce, sweet corn, turnip, and peanuts, and were injurious in greenhouses.

The strawberry weevil (*Anthonomus signatus* Say) caused much injury in the neighborhood of Grists, N. C., the estimate being 50 per cent of the strawberry crop, or a cash loss of $700,000. It also caused damage in Connecticut and Michigan.

The strawberry crown girdler (*Otiorhynchus ovatus* L.) was injurious to strawberry in the Hood River region of Oregon and in the vicinity of Columbus, Kans.

The strawberry root-aphis (*Aphis forbesii* Weed?) was reported injurious at Norfolk and Blacksburg, Va., in northern Ohio, and in the vicinity of Fort Wayne, Ind., but the species was not positively identified.

A strawberry root-worm, *Typophorus canellus* Fab., was injurious to strawberry at Chattanooga, Tenn., and Norfolk, Va.

The raspberry cane-borer (*Oberea bimaculata* Ol.) was injurious to raspberry in the vicinity of Utica, N. Y.

The raspberry blossom beetle (*Byturus unicolor* Say) was very injurious to raspberries in northern Ohio and at Manchester, Iowa.

Insects Injurious to Forests and Forest Products.

The Black Hills beetle (*Dendroctonus ponderosæ* Hopk.) continued its depredations in the Rocky Mountain regions. Extensive damage to yellow pine was reported from most of the National Forests of Colorado, Utah, and northern Arizona. A careful examination of twelve of the eighteen National Forests in Colorado showed that the amount of insect-killed yellow pine varied from 3 to 20 per cent, or an average of 8 per cent.

The mountain pine beetle (*Dendroctonus monticolæ* Hopk.) killed a large amount of lodgepole pine in Wyoming, northeastern Oregon, and California, western white pine in northern and central Idaho, and yellow pine and sugar pine in California.

The destructive pine beetle (*Dendroctonus frontalis* Zimm.) is still actively at work in the Southern States. A large number of loblolly pines at Virginia Beach, Va., were killed by this beetle in 1907 and 1908.

A newly discovered barkbeetle, the Jeffrey pine beetle (*Dendroctonus jeffreyi* Hopk.), committed extensive depredations on the Jeffrey pine and yellow pine in the Sierra Nevada region of California and Nevada.

The Douglas fir beetle (*Dendroctonus pseudotsugæ* Hopk.) caused serious damage to the Douglas fir over the entire Rocky Mountain region. It was reported from Montana to Arizona. The amount of insect-killed Douglas fir in eleven of the eighteen National Forests of Colorado varied from 2 to 15 per cent, with an average of 6 per cent.

The Engelmann spruce beetle (*Dendroctonus engelmanni* Hopk.) proved a serious enemy of the Engelmann spruce in Colorado and New Mexico. A careful examination of twelve of the eighteen National Forests of Colorado showed that the insect-killed Engelmann spruce varied from 4 to 12 per cent, or an average of 7 per cent.

The southern pine sawyer (*Monohammus titillator* Fab.) was very destructive to storm-felled pine timber in the Southern States. Most of the sapwood is riddled by the larval mines, which reduces the value of the timber about 25 per cent. It is estimated on good authority that the reduction in value of the storm-felled timber in Mississippi, Louisiana, and Arkansas to be charged to this insect amounts to $6,000,000.

Severe damage to fire-killed Douglas fir timber by borers (Cerambycidæ) was reported from Clark County, Wash. One company abandoned ten sections because the insect injury reduced the amount cut from 30,000 feet B. M. to the acre to 15,000 feet B. M., which made logging unprofitable. This injury thus caused a total loss of 192,000,000 board feet, or a net loss to the company of 96,000,000 feet. The 192,000,000 feet, at a stumpage value of $2.50 per 1,000 feet B. M., would mean a total loss of $480,000.

The two-lined chestnut borer (*Agrilus bilineatus* Weber) is still intimately associated with, and probably causes the dying of the chestnut trees which is so common throughout the Middle Atlantic States.

The fir bark maggot (*Cheilosia hoodiana* Bigot) was found to cause a serious defect (check) in the otherwise valuable timber of the red fir (*Abies magnifica* Murray) in the mountains of northern California.

Borers (Ptinidæ, Scolytidæ, Cerambycidæ, and Buprestidæ) were reported as very destructive to rustic houses in California and the New England States.

Powder-post beetles (*Lyctus* spp. and *Sinoxylon* spp.) continue to cause serious injury to seasoned hardwood products. Extensive experiments for determining the best methods for the control of these insects have been undertaken by a large manufacturing company in cooperation with the Branch of Forest Insect Investigations of the Bureau of Entomology.

The pine butterfly (*Neophasia menapia* Felder) defoliated large areas of yellow pine in the Chelan, Colville, and Wenatchee National Forests of northeastern Washington and in Klickitat County, southern Washington. In many places the trees were entirely defoliated and in others the foliage turned brown.

Extensive defoliations of the beech, maple, birch, and other hardwood trees by several caterpillars, the most important of which was *Heterocampa guttivitta* Walker, were observed and reported from the northern New England States.

The larch sawfly (*Holcocneme* [*Nematus*] *erichsonii* Hartig) continued to be abundant and destructive to the larch in the upper peninsula of Michigan, and was reported as injurious from Wisconsin.

The fir sawfly (*Lophyrus abietis* Harris) defoliated much of the balsam fir on the islands and mainland along the coast of Maine.

The cedar tineid (*Argyresthia* [*Bucculatrix*] *thuiella* Pack.) has proven to be a serious enemy of the arborvitæ in the Middle Atlantic States. It mines the leaves, which causes them to turn brown and gives the tree a sickly and unsightly appearance.

The pine bark-louse (*Chermes pinicorticis* Fitch) was found to be commonly associated with and evidently causes a considerable percentage of the white-pine twig blight which has been so prevalent in the New England States the past year. The spruce gall lice (undoubtedly several species of Chermes) have attracted more than usual attention and caused inquiries from nearly all of the forested regions of the United States because of the unsightly galls on the twigs of the various species of spruce.

The Douglas fir cone moth (*Cydia pseudotsugana* Kearfott) was reported as causing serious damage to the seed in the cones of the Douglas fir in Montana, while the same, or a similar species, was very destructive to the seed in the cones of the Engelmann spruce in Colorado. Another unidentified species was equally as destructive to the seed in the cones of the western yellow pine.

Deciduous Fruit Insects.

The season of 1908 has not varied much from preceding years in respect to insect depredations on various orchard and vineyard crops. Most of the important orchard pests have been in evidence and have caused about the usual loss. A gradual increase is to be noted from year to year in the adoption by orchardists of the recommendations made by the Bureau of Entomology and the experiment stations for the control of the more troublesome species, and a greater thoroughness in spraying is resulting in an increased percentage of perfect fruit.

The codling moth (*Carpocapsa pomonella* L.), as in former years, was generally present in orchards, exacting the usual toll from fruit growers. Complaint of serious injury to pears was made from New Mexico and also from California. Notable results are reported in the control of this pest from the Pacific Northwest by the so-called "one-spray" method, which consists in the application of an excessive amount of the arsenical spray to the trees shortly after the petals have fallen, using a coarse nozzle with crook and very high pressure. This method has not yet been sufficiently tested in the East to determine its applicability for that region, where the arsenical is usually applied with Bordeaux mixture, effecting a combination treatment for insects and fungous diseases.

The lesser apple worm (*Enarmonia prunivora* Walsh) was much in evidence in Arkansas and Missouri, and was the subject of inquiry from New York State and Canada.

Argyresthia conjugella Zell., known for some years in British Columbia, has been found to have gained a foothold in Washington State, and was the subject of a limited investigation by the Bureau of Entomology during the summer of 1908. The larvæ bore into apples, plums, etc., and in infested orchards the loss occasioned may be quite extensive.

Epinotia pyricolana Murtf. was quite abundant in apple orchards around Siloam Springs, Ark., during the summer of 1908, the larvæ boring into the shoots of young trees and the water sprouts of older trees. Later in the season, when the shoots had become hard, the fruits were attacked, the larvæ injuring them in much the same way as the lesser apple worm.

The spring canker-worm (*Paleacrita vernata* Peck) was abundant in apple orchards in Arkansas, Missouri, Nebraska, and northern Virginia. The fall canker-worm (*Alsophila pometaria* Harr.) was unusually prevalent in the New England States, especially in Connecticut, infesting orchard, shade, and woodland trees.

The pear thrips (*Euthrips pyri* Daniel) was again quite destructive to prunes, pears, cherries, etc., in orchards in the San Francisco Bay region, in California, the loss being estimated at from one-half to three-quarters of a million dollars. This insect has continued to spread, and its ravages have occasioned much alarm and comment among orchardists. Experiments by the Bureau of Entomology in the fall of 1908 and the spring of 1909 show that the insect may be controlled in two practical ways, namely, by thorough plowing and cross plowing of infested orchards during October

and November, when the insect is in the pupal stage in the soil; and by the destruction of adults and larvæ on the trees by spraying. The pear thrips is not yet known outside of the San Francisco Bay region, in California, its reported occurrence in the Auburn and New Castle fruit districts, in that State, not having been verified.

The pear-leaf blister mite (*Eriophyes pyri* [Pagenst.] Nal.) continued much in evidence in apple orchards in western New York State, where it has been investigated by the Geneva Agricultural Experiment Station. About the usual amount of complaint was received from pear growers in various parts of the country.

Orchard scale insects have been complained of about as in former years. The San Jose or Chinese scale (*Aspidiotus perniciosus* Comst.) has now in most sections become merely one of those orchard pests whose control must be enforced from year to year. The presence of the scale has been discovered in Iowa, and its increasing spread in Arkansas and its occurrence in Kansas and Oklahoma have led these States to undertake active measures to restrict its distribution and to insure its control where already established.

During the past two or three years the brown apricot scale (*Eulecanium persicæ* Fab.) has become quite abundant in apricot and prune orchards in the Santa Clara Valley, in California, and in many orchards by midsummer the foliage and fruit are well coated with the exuding honeydew. Experiments with various sprays are under way by the Bureau of Entomology in orchards in the Santa Clara Valley.

The grape scale (*Aspidiotus uvæ* Comst.) has been rather more in evidence than in former years and complaint of serious injury has been received from Arkansas. However, the usual practice of pruning off grape canes each year will doubtless serve to keep this species always well in check.

The orange thrips (*Euthrips citri* Moulton), an additional orange pest, has recently come into prominence in California in the Porterville orange district, and it has also been reported from the orange-growing region of Arizona. A special investigation of this species is under way by the Bureau of Entomology.

The peach-tree borer (*Sanninoidea exitiosa* Say) has been the subject of the usual amount of complaint, particularly from peach growers who have recently gone into the business and who have not become acquainted with this universal peach enemy and with the methods for its control.

The plum curculio (*Conotrachelus nenuphar* Hbst.) has varied considerably in abundance in various parts of the country. In certain Georgia peach orchards badly infested during the season of 1907 the insect was practically absent in 1908, possibly due to the increase of its parasitic enemies.

The saddled prominent (*Heterocampa guttivitta* Walk.) during the past two or three years has been unusually abundant in the New England States, defoliating apple orchards.

The rose-chafer (*Macrodactylus subspinosus* Fab.), in the environs of Washington, has been unusually abundant, and it was very destructive to grapes in Van Buren County, Mich., and also in New Jersey, especially in the vicinity of Vineland.

The grape root-worm (*Fidia viticida* Walsh) continues to be a pest of much importance in the Erie and Chautauqua grape belts. The experiments and demonstrations in spraying and renovation of injured vineyards by the Bureau of Entomology are still in progress.

The grape blossom bud-gnat (*Cecidomyia johnsonii* Sling.), while more or less in evidence most years in vineyards in the Erie and Chautauqua grape belts, attracted particular attention in the spring of 1908 by reason of its abundance in a small vineyard near Fredonia, N. Y. A large percentage of the blossoms of the Moore Early grape in the infested vineyard was destroyed.

The grape plume moth (*Oxyptilus periscelidactylus* Fitch) continues apparently rather abundant in portions of the New England States, as occasional complaint of its injuries were received from Massachusetts and Connecticut.

The vine-hopper (*Typhlocyba comes* Say) was abundant in vineyards in the Chautauqua and Erie grape belts and was complained of by California vineyardists. In the latter State it has been recently investigated by the California State Agricultural Experiment Station.

The tussock moth (*Hemerocampa leucostigma* S. & A.) was particularly abundant in western New York and occasioned important injury to apples, especially in the vicinity of Lockport. The larvæ fed upon the foliage and fruit. This species has been well investigated by the New York Agricultural Experiment Station.

The cranberry fruit worm (*Mineola vaccinii* Riley) has proven to be the most important insect enemy of cranberries in Wisconsin, and has been given especial attention in the investigation of cranberry insects by the Bureau of Entomology. Results of experiments indicate the efficiency of applications of arsenical sprays, a large percentage of the crop being protected by two timely applications.

The currant fruit-fly (*Epochra canadensis* Loew) has been the subject of several complaints, notably from Maine, Montana, South Dakota, and California.

Systena collaris Cr. was received from Texas in April, and was reported as devouring the leaves of peach trees.

Pomphopœa ænea Say was received from Texas, and was reported as feeding upon peach blossoms and foliage.

Haltica carinata Germ. was enormously abundant in vineyards in the vicinity of Cucamonga, Cal., in late April, in company with *Ulus crassus* Lec.

Colaspidia varicolor Cr. was received from Auburn, Cal., in June, where it was feeding on the foliage of plum, and to a less extent upon the young shoots.

Insects Injurious to Citrus Fruits.

The citrus white fly (*Aleyrodes citri* R. & H.) was unusually destructive in Florida. It has spread into previously uninfested sections, its work being more marked than in former years. It is also attracting great attention in the citrus belt of southern Texas, where growers are actively agitating eradication. Two forms of white fly were common, the second species being commonly known as the "smoky winged" (*A. nubifera* Berger). The latter has a more distinctive distribution.

The principal scale-insect pests on citrus fruits in the Gulf region were the purple scale (*Lepidosaphes beckii* Newm.), the long scale (*Lepidosaphes gloverii* Pack.), and the Florida red scale (*Chrysomphalus ficus* Ashm.). Injury by these forms was estimated at about 5 per cent. Where spraying or fumigation and other protective measures are not adopted much injury is apt to result from the attacks of any of these pests. During 1908 the purple scale occasioned severe loss as a secondary result of the weakening of citrus trees by the white fly, *A. citri.*

The guava cottony scale (*Pulvinaria psidii* Mask.), a serious pest in the Oriental regions on a wide range of food plants, has appeared in Florida, and in the future will no doubt prove to be a pest of considerable importance.

A large green pentatomid bug (*Loxa flavicollis* Dru.) was reported in vast numbers on pomelo or grape-fruit trees near Miami, Fla. It injures the young foliage by sucking the sap, causing the leaves to turn black and fall.

Insects Injurious to Shade Trees.

The white-marked tussock moth (*Hemerocampa leucostigma* S. & A.) was scarcely a pest during the season, yet a few inquiries were made in regard to it. These came from isolated localities in New York, westward to Iowa, and were chiefly of the same nature—requests for the destruction of the insect and advice as to remedies.

The fall webworm (*Hyphantria cunea* Dru.) did not attract much attention from its injuries to shade trees, the year being a very exceptional one.

The bagworm (*Thyridopteryx ephemeræformis* Haw.) was nearly as injurious as in 1907. Complaints were made of its ravages on cedar, arborvitæ, ornamental, and other trees in Pennsylvania, Virginia, Indiana, Alabama, South Carolina, and Texas.

The elm leaf-beetle (*Galerucella luteola* Müll.) was, all things considered, the worst shade-tree pest of the year. It was particularly injurious in portions of New York, Connecticut, and New Jersey, as also at Durham, N. C. Injury in the District of Columbia, which was once very severe, was confined to one small grove of European elms.

The catalpa midge (*Cecidomyia catalpæ* Comst.) was injurious to the foliage, terminal buds, and seed pods of catalpa in Ohio, where it was studied.

The green-striped maple worm (*Anisota rubicunda* Fab.) was one of the most injurious shade-tree pests of the season, stripping the leaves of maple, beech, and forest trees in various localities. It was particularly troublesome in Maine and New Hampshire, as also in West Virginia and Pennsylvania.

The hickory tiger moth (*Halisidota caryæ* Harr.) was destructive in portions of New York, New Jersey, and New Hampshire.

The black walnut caterpillar (*Datana integerrima* G. & R.) was very troublesome by the defoliation of walnut trees in the North, especially in Ohio, Iowa, Pennsylvania, and Virginia, and of pecans in Florida and Alabama.

The prominent forest caterpillar (*Heterocampa guttivitta* Walk.), although injurious chiefly to forest trees, also did some injury to shade trees, and especially to maple groves in northern Vermont.

A sawfly (*Euura salicis-nodus* Walsh) was destructive to willow shoots grown for manufacture at Sheboygan, Wis.

The imported willow curculio (*Cryptorhynchus lapathi* L.) continues its ravages on willow, poplar, and cottonwood. Injuries were reported from new localities in Pennsylvania, Massachusetts, Minnesota, and Wisconsin.

Reports of injury to birch trees by the bronze birch borer (*Agrilus anxius* Gory) have been received from new localities in Pennsylvania, Ohio, and Illinois. Probable injury was reported at Chicago to balm of Gilead. A related form (*Agrilus* sp.) was implicated in attack to willow in California.

The two-lined chestnut borer (*Agrilus bilineatus* Web.) was reported injurious to chestnut in New Jersey, to chestnut and chinquapin in Virginia, and to oak shade trees in the District of Columbia.

The spurred poplar borer (*Saperda calcarata* Say) was injurious at Detroit, Mich., and Chicago, Ill.

The elm-tree borer (*Saperda tridentata* Oliv.) was reported as a pest in portions of Missouri and Michigan.

The ash or lilac borer (*Podosesia syringæ* Harr.) was injurious to ash in Massachusetts, Tennessee, Illinois, and Kansas.

The sugar-maple borer (*Plagionotus speciosus* Say) was the subject of complaint in Maine, Connecticut, New York, and the mountainous region of Virginia.

Aphides were quite abundant on many kinds of shade trees, the most troublesome being the box-elder aphis (*Chaitophorus negundinis* Thor.), which threatened a serious outbreak in Nebraska. At Washington, D. C., the tulip-tree aphis (*Macrosiphum liriodendri* Cook) defoliated the tulip poplars of the city streets and avenues.

The canker-worms were reported injurious to basswood, beech, and birch in Canada.

An insect of somewhat similar habits to a canker-worm, *Ennomos subsignarius* Hbn., which was very troublesome in the United States, was the cause of considerable comment because of its abundance in Canada.

Insects Injurious to Ornamental Plants.

The season of 1908 was a rose-chafer year. In addition to the injuries reported under "Deciduous fruit trees" the rose-chafer (*Macrodactylus subspinosus* Fab.) attracted much attention on account of its ravages on rose and other ornamentals in Pennsylvania, Long Island, New Jersey, Illinois, Maryland, and Connecticut.

The rose leafhopper (*Typhlocyba rosæ* L.) was injurious from Canada southward to the District of Columbia and westward to Indiana, Illinois, and Michigan.

The rose slugs of three species were about as injurious as in previous years.

The rose leaf-beetle (*Nodonota puncticollis* Say) was injurious to roses in the District of Columbia and to Japanese chestnut at Stamford, Conn.

The large rose aphis (*Macrosiphum rosæ* L.) was, as usual, abundant and troublesome in the District of Columbia, as also in Virginia, New York, Pennsylvania, and North Carolina.

Fuller's rose beetle (*Armigus fulleri* Horn) appeared in greenhouses at Washington, D. C., injuring the leaves of blueberry.

The strawberry thrips (*Euthrips tritici* Fitch) was the cause of serious trouble to chrysanthemums and roses at New Orleans, La., to roses in Maryland, and to strawberry in Florida.

The golden-glow aphis (*Macrosiphum rudbeckiæ* Fitch) was unusually troublesome on rudbeckia, sunflower, and chrysanthemum. Reports of injury were received from New York, westward to Michigan and southward to Texas, and also in California.

The chrysanthemum aphis (*Macrosiphum chrysanthemicola* Wms. MS.) was injurious to chrysanthemum in Virginia and South Carolina.

The greenhouse red spider (*Tetranychus bimaculatus* Harv.) occasioned much complaint generally throughout the country in greenhouses. It was also injurious in the field in the Gulf region, the injury being most noticeable on cucumber, beans, eggplant, and ornamentals. At Washington, D. C., it caused damage to shade trees.

The greenhouse thrips (*Heliothrips hæmorrhoidalis* Bouché) was injurious to croton in Florida and to fuchsia and fern in Southern California.

Of the greenhouse white fly (*Aleyrodes vaporariorum* Westw.) more complaints than usual were received.

The white ant (*Termes flavipes* Koll.) injuriously affected the stalks of geranium at Essex Falls, N. J.

The fickle midge (*Sciara inconstans* Fitch) was reported injurious in greenhouses in Chicago, Ill., and in California. The related *Sciara tritici* was injurious in greenhouses in Ohio.

The Florida fern caterpillar (*Callopistria floridensis* Guen.) has been injurious in local greenhouses, one florist reporting damage to his ferns to the extent of $4,000.

A species of aphis, *Aphis angelicae* Koch (?), was concerned in injury to iris at Santa Ana, Cal., in December.

The argus tortoise beetle (*Chelymorpha argus* Licht.) was accused of playing havoc with morning-glory and moon-flower vines in western Texas, larvæ and adults both being concerned in the attack.

Insects Injurious to Pecan.

The pecan budworm (*Proteopteryx deludana* Clem.) was less destructive than for several seasons. At Dewitt, Ga., it is being successfully controlled by spraying with arsenate of lead.

The pecan huskworm (*Enarmonia caryana* Fitch) was the subject of complaint as a pecan pest in Texas, South Carolina, Louisiana, Alabama, and Georgia.

The pecan webworm (*Hyphantria textor* Harr.) was injurious to pecan in Georgia, South Carolina, and Alabama.

The phylloxeras, *Phylloxera caryæ-caulis* Fitch, *Ph. notabilis* Perg., and *Ph. perniciosa* Perg., were the subject of complaint of injury to pecan in Mississippi, Georgia, and Texas. The first was also extremely abundant on hickory in New York and Pennsylvania.

Among other pecan insects which came under observation, but which were responsible for only minor injury, were the walnut sphinx (*Cressonia juglandis* S. & A.) in Florida, Texas, and South Carolina, the pecan leaf-miner (*Coleophora caryæfoliella* Clem.) in Florida and Texas, and another leaf-miner (*Lithocolletis caryæfoliella* Clem.) in Alabama and Florida.

The twig girdler (*Oncideres cingulata* Say) was the subject of many complaints of injury to pecan generally throughout the South, and to elm in Kansas. It was also accused of riddling persimmon, hickory, English walnut, and citrange.

The pecan weevil (*Balaninus caryæ* Horn) was injurious to pecan in Texas.

The walnut curculio (*Conotrachelus juglandis* Lec.), sometimes injurious to pecan, was injurious to the fruit of black walnut at Petersburg, Va.

Insects Injurious to Stored Products.

Many complaints of flour beetles in export flour and other cereals shipped to England and other European ports and Africa have been made, and an investigation shows that certain of these species have increased their range and one has appeared in this country for the first time.

The rust-red flour beetle (*Tribolium ferrugineum* Fab.), which a decade ago was practically a pest only in the Southern States, has been introduced farther northward in mills and warehouses, while the confused flour beetle (*Tribolium confusum* Duv.), the dominant species in the North, has found its way southward, so that both species are now apt to be found in almost any mills, especially from Illinois and Minnesota southward to Texas, in the principal grain-growing sections of the country.

The broad-horned flour beetle (*Gnathocerus cornutus* Fab.) and the small-eyed flour beetle (*Cænocorse [Palorus] ratzeburgi* Wissm.) have been reported in new localities in the section mentioned, and a species related to the latter, *Cænocorse subdepressa* Woll., has also been found in mills southward.

A grain borer, *Rhizopertha dominica* Fab. (*Dinoderus pusillus*), a species not hitherto known to be permanently established in this country, is now known to occur destructively in the South, and is apt to be a pest of great importance because of its habit of boring through grain bags and even into wood, affording entrance for other injurious beetles which otherwise would not be able to attack the grain.

The Mediterranean flour moth (*Ephestia kuehniella* Zell.), the worst mill pest on our continent, was the subject of much complaint from its injuries in flour mills in Kansas and to a lesser degree in Iowa, Minnesota, and California. In the last two States it has been permanently established for years and it has increased in destructiveness in Kansas. It has become established the present year in the District of Columbia in a large bakery. There is evidence also of its presence in other new localities.

The square-necked grain beetle (*Cathartus gemellatus* Duv.) which has not caused noticeable trouble in recent years, was accused of doing considerable injury to corn at San Antonio and was concerned in injury to corn in the ear at Brownsville, Tex.

The foreign grain beetle (*Cathartus advena* Walk.) came under observation in different localities in Kansas and Texas.

The merchant grain beetle (*Silvanus mercator* Fauv.) was observed working in dried peanuts from Dayton, Ohio.

The cigarette beetle (*Lasioderma serricorne* Fab.) apparently increases in destructiveness. Complaints of it in tobacco warehouses were somewhat general, but it attracted more attention in North Carolina, Florida, Pennsylvania, Ohio, Indiana, and Iowa.

A mite (*Carpoglyphus passularum* Hor.) was exceedingly troublesome to dried apples in Virginia and Alabama.

The white ant (*Termes flavipes* Koll.) was observed for the first time to be injurious to stored cereals, attacking rice in Louisiana, as also dry peanuts from Virginia.

Insects as Animal Parasites and as Conveyors of Disease.

The North American fever tick (*Margaropus annulatus* Say) was considerably less than normally abundant in 1908. Very few cattle were found to have died from gross infestation, although a great many perished in this way in 1907, but the general damage as parasites was very considerable. The loss due to the various results of tick damage on the whole amounted to the usual annual figure—in the neighborhood of $40,000,000.

The spinose ear tick (*Ornithodoros megnini* Dugès) was present in usual numbers. As usual some attacks upon human beings came to notice.

The lone star tick (*Amblyomma americanum* L.) is a very important parasite of cattle, sheep, and goats, and occurs most numerously in regions where the latter animals are reared in numbers. In Louisiana this tick is of considerable importance as a parasite of human beings. There is wide difference in individual susceptibility, but many persons suffer severely from their attack. More than the usual damage occurred in 1908.

The Gulf coast tick (*Amblyomma maculatum* Koch) though restricted to a comparatively small area along the coast of Texas and Louisiana, is of great local importance. The damage in 1908, however, was not above the normal.

The fowl tick (*Argas miniatus* Koch) was fully as numerous as usual and several infestations far outside of the general infested area were found. This tick seems to be establishing itself in widely separated localities.

The horn fly (*Hæmatobia serrata* Desv.) occurred numerously throughout the season in Texas, although the numbers were reduced for short periods by dry weather.

Bot-flies (*Gastrophilus* spp.) attracted no special attention.

The screw-worm fly (*Chrysomyia macellaria* Fab.) was more numerous than usual in southern Texas in the spring of 1908, where many young cattle were killed. Its damage was made greater by the weakened condition of cattle due to a drought in the early spring.

PROGRESS OF GAME PROTECTION IN 1908.

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INTRODUCTION.

The year 1908 was not marked by any event of special importance, but a number of factors, each more or less noteworthy, at least in certain localities, affected the condition of game and the success of the hunting season. On the whole, the game wintered well, and conditions in the spring were better than normal. During the summer a prolonged drought accompanied by extensive forest fires occurred in several of the Northern States, and threatened serious injury to deer and grouse, but the actual loss proved less than was at first predicted. In the Carolinas and Georgia unusual floods in August and September caused great destruction of deer and wild turkeys, particularly in South Carolina. The continued difficulty of obtaining game birds for stocking covers increased general interest in the Hungarian or gray partridge of Europe, and resulted in the importation of a much larger number of these birds than in any previous year.

The success of the hunting season was affected somewhat by the general elections and also by the financial depression of 1907–8. The latter condition in some cases prevented extended hunting trips, and in others afforded men temporarily out of employment an opportunity for hunting. In Vermont the open season was suspended from October 23 to November 8, and the deer season postponed two weeks because of the drought, which greatly increased the danger of forest fires. In New Jersey a light snowfall in some of the counties on the opening day created some uncertainty on account of the law prohibiting hunting in tracking snow, and in California the ducking season was affected by long-continued rains in December. The record of the season as a whole was marred by many fatal hunting accidents, in all probably not less than 100. Many of these accidents occurred in connection with deer hunting; others in hunting small game, especially waterfowl.

The rapidly increasing popularity of the automobile and the power boat in the pursuit of game is apparently affecting the abundance of certain species in some localities and seems to indicate the necessity for better regulation of such methods of hunting.

Comparatively little general legislation was enacted during the year, and consequently few changes were made in the game laws. Although a number of cases were carried to the higher courts, the questions at issue, with few exceptions, were neither novel nor of great importance. One case, however, was decided by the Supreme Court of the United States, upholding the right of a State to regulate the sale of imported game, and finally set at rest a question which had been before the State courts for thirty years.

Widespread interest was aroused in the conservation of natural resources, and attention directed to the importance of ascertaining more accurately the present condition of game and devising better methods of propagating birds to restock depleted covers.

THE CONDITION OF GAME.

The condition of game as a whole has not materially changed since last year, although in some respects it was more favorable than in 1907. No serious outbreaks of disease, either of black tongue among deer or quail disease among upland game birds, were reported. Little loss occurred during the winter, and in some localities the woodcock shooting and the flight of ducks were considerably above the average. In many sections of the country the condition of upland game birds was far from satisfactory, and in some places unfavorable weather interfered with the success of the hunting season for wild fowl. A comprehensive statement of the condition of game in the United States is necessarily unsatisfactory on account of lack of adequate reports from many important localities. All that is possible is to indicate the salient facts regarding the principal kinds of game in a few sections of the country.

BIG GAME.

DEER.—The condition of deer continued favorable, no undue destruction being reported, except from South Carolina. Here floods forced the deer in the river bottoms to take refuge on islands, where in some localities they were slaughtered in large numbers. An interesting illustration of the increase of deer is afforded by the record in western Michigan, where, after four years' continuous protection, the season was opened this year in six counties and nearly 400 deer were killed.

In about one-fourth of the States deer have either been killed off or are so scarce that the season is closed throughout the year in order to give the few which still remain a chance to increase. The States which had no deer hunting in 1908 were Massachusetts, Rhode Island, Connecticut, New Jersey, Delaware, Tennessee, Kentucky, Ohio, Indiana, Illinois, Iowa, Nebraska, Kansas, and Oklahoma. In most of the other States the deer season, ranging from six days in Vermont to four months or more in some parts of the South, seems to have been fairly successful. The only States west of the Mississippi from which any statistics are available are California and Colorado. In thirteen counties in California, including the most important deer-hunting sections of the State, reports indicate that more than 2,200 deer were killed. In Colorado the total number killed is estimated at 2,500. Much more satisfactory figures are available for the Eastern States. Statistics of the number of deer shipped have been reported for a series of years from Maine and New York, and returns of the number killed have been made by the State game commissioners of Vermont, Pennsylvania, Michigan, and Wisconsin. During the past season returns were collected from practically all of the States east of the Mississippi, except New Hampshire, North Carolina, and Georgia. These returns show a total of about 60,000 deer killed,[a] as follows:

Maine	15,000	Virginia	207
New Hampshire	.....	North Carolina	.....
Vermont	2,700	South Carolina	1,000
New York	6,000	Georgia	.....
Pennsylvania	500	Florida	2,209
Michigan	9,076	Alabama	152
Wisconsin	11,000	Mississippi	411
Minnesota	6,000	Louisiana	5,500
West Virginia	107		
Maryland	16	Total	59,878

The total may be accepted as a fair approximation of the number of deer killed, the lack of statistics in three of the States being offset by rather high estimates in one or two others. These figures indicate that the large northern form and the small Florida form are much more abundant than the typical Virginia deer of the Middle Atlantic States.

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[a] Besides these the estimate for the Province of Ontario is 12,000.

ELK.—Of the States in which elk still occur, only Wyoming, Montana, Idaho, and Oregon permitted hunting. In Wyoming the number reported as killed under license—only part of the total number killed in the State—was 384, as compared with 345 in 1907. No statistics are available for the three other States. The State warden of Wyoming reports the condition of the elk in northwestern Wyoming—the largest herd in the country—as unusually encouraging, due to a favorable winter, absence of tusk hunting, close supervision, and intelligent interest on the part of citizens in the elk country. In Colorado several herds of 150 to 200 were reported from Routt County, where there are now more elk than in any other part of the State. Ten years ago the number of elk in Colorado was estimated at 7,000.

MOOSE.—Only two States—Maine and Minnesota—permit moose hunting. In Maine about one-fourth of the guides reported the number of moose as less than that of last year, while the others reported it about the same or somewhat greater. The number of moose shipped over the various railroads was 175, as compared with 225 the previous year, and while there was some falling off in the number of bull moose killed, apparently more cow and calf moose than usual were killed illegally. Large heads were scarce. In Minnesota the number of moose shipped was 87. Reports show that moose are present also in two of the eastern counties of the Upper Peninsula in Michigan, in northwestern Wyoming, in Montana, and in Idaho.

ANTELOPE.—Antelope are still found in diminished numbers in 14 Western States. A considerable number were killed during the year in Montana, where the species seems to have suffered more than elsewhere since the season was opened in 1907. A striking illustration of the decrease of antelope is afforded by Colorado. In 1898 the State warden estimated that there were 25,000 in the State, whereas in 1908 the game commissioner places the number at only about 2,000. The total number of antelope now in the United States probably does not exceed 17,000,[a] distributed approximately as follows:

Colorado	2,000	Wyoming	4,000
Idaho	200	Yellowstone Park	2,000
Montana	4,000	Other States	2,000
New Mexico	1,300		
Oregon	1,500	Total	17,000

MOUNTAIN SHEEP.—No appreciable change in the status of the mountain sheep has been reported from Wyoming or other States where they still occur. In Colorado special efforts have been made, and with considerable success, to protect sheep during the past two years. In Oregon a few sheep still remain in the eastern part of the State, where efforts have also been made to afford them special protection.

BUFFALO.—A census taken by the American Bison Society showed that on January 1, 1908, the total number of buffalo was 2,047, distributed as follows: Wild, 25 in the United States and 300 in Canada; captive, 1,116 in the United States, 476 in Canada, and 130 in Europe. The total number of captive buffalo in America was thus 1,592 as compared with 1,010 in 1903, an increase of 50 per cent in the last five years. The number of cattalo was 260 in the United States, 57 in Canada, and 28 in Europe, or a total of 345 as compared with 281 in 1903.

During the summer attempts were made to round up the remaining buffalo of the Pablo-Allard herd on the Flathead Indian Reservation for the purpose of transferring them to Canada, but they proved unsuccessful.

GAME BIRDS.

QUAIL.—On the whole, the season seems to have been a favorable one for quail. Reports indicate that the birds were more abundant than usual in the Ohio Valley, Oklahoma, Colorado, several of the Gulf States, and parts of Massachusetts, New Jersey, and Iowa. In California the season opened well, but the birds soon became scarce. The favorable conditions in Massachusetts, New Jersey, and Illinois are largely due to the liberation of birds in recent years. On the other hand, reports from southern Virginia and certain sections in North Carolina indicate that quail were unusually scarce, possibly due to the wet season and the unusual floods. In some parts of North Carolina the number was estimated as one-third less than last year. The quail disease, which proved so destructive in 1907, was not reported this season, but its apparent absence may have been due largely to the fact that comparatively few shipments of birds were made, and consequently the disease was not spread further or brought to general notice.

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[a] In Canada the number in Saskatchewan is estimated at nearly 2,000; allowing for those in Alberta the total number north of Mexico is still less than 20,000.

GROUSE.—In the Northeastern States ruffed grouse were apparently more numerous than in 1907 and give promise of early recovery from their recent scarcity. In Pennsylvania reports are conflicting, some indicating increase, others a decrease in the birds in certain localities. Reports from Tennessee and some parts of Kentucky are favorable. In the Middle West the condition of the prairie chicken is far from satisfactory. Reports from Illinois indicate that notwithstanding the close season since 1903 the birds have not increased recently, and in neighboring States they are gradually disappearing. In some sections of Iowa and in eastern Oklahoma they have now been practically exterminated. In the West, according to reports, the condition of the blue grouse is slightly better than last year, but in Wyoming, western Idaho, and northeastern Utah the birds were unusually scarce.

WILD TURKEY.—The wild turkey is no longer found in abundance over any wide area, and the places where it is common are widely separated. Reports indicating its occurrence in greater numbers than usual were made from North Carolina, western Florida, and some localities in Texas, Kentucky, and Missouri. Two-fifths of the counties in West Virginia reported wild turkeys present and 14 of these counties reported a total of 183 birds killed. In Florida estimates received from a little more than one-half the counties indicate about 2,000 turkeys killed. In Kentucky turkeys were reported present in only 8 counties, where about 100 birds were killed.

WOODCOCK.—One of the most interesting features of the season was an unusually large flight of woodcock which came down the Atlantic seaboard through the New England States during the early part of November. The birds were reported as fairly numerous in southern Maine and New Hampshire, and also in some parts of Vermont, and as the flight proceeded southward they apparently increased in numbers. Large bags were secured in a number of localities, particularly in Connecticut and New Jersey. Reports of the abundance of woodcock were received also from southern Michigan. On the whole, the flight seems to have been larger than that of any other season in recent years, although precise data are lacking for a direct comparison, either as to its extent or the abundance of the birds.

RAIL.—Rail were reported as abundant at several points along the Atlantic coast at the opening of the season, particularly in the vicinity of Essex and Milford, Conn.; Salem, N. J.; and on the marshes of the Patuxent, Potomac, and York rivers.

DUCKS.—In general, the duck season was much better than for several years previous. On the eastern coast black ducks were abundant, and in Connecticut and the upper Mississippi Valley, particularly Minnesota and Illinois, wood ducks were more numerous than for years. In South Dakota, Texas, Utah, and California ducks were unusually abundant. On the other hand, the fall shooting in Wisconsin, Michigan, Illinois, and Indiana was not very good, and reports from the upper Chesapeake and eastern Virginia indicated that the birds were not present in their usual numbers. The hunting season on Currituck Sound, North Carolina, was below normal because of stormy weather. But in spite of local scarcity, the abundance of birds in nearly all the great ducking centers of the United States marked the year as unusual.

The beneficial results of laws prohibiting shooting in spring were exemplified in several States, particularly in Wisconsin and Connecticut. In southern Wisconsin better bags were secured on the opening day of the season this year than for several years past, and in Connecticut many ducks have bred since the new law was passed in 1907. Some increase in the wood duck has also been noted in New Hampshire and Massachusetts since the enactment of a close season for five years.

WILD GEESE.—Geese were abundant in some States, as shown by reports from such widely separated localities as Port Lavaca, Tex., and the Sacramento Valley, California.

NATIONAL PARKS, GAME REFUGES, AND BIRD RESERVATIONS.

The reservations under Federal jurisdiction utilized as refuges and breeding grounds for game comprise three National parks, two National game refuges, the Niobrara Military Reservation, 25 bird reservations, and several light-house reservations to which colonies of seabirds resort to rear their young. All except the bird reservations contain big game. Herds of buffalo have been placed in the Yellowstone Park and on the two game refuges, and preparations are being made to establish another herd on a proposed bison range on the Flathead Indian Reservation in Montana.

YELLOWSTONE NATIONAL PARK, WYO.—The superintendent reports that the big game in Yellowstone National Park is doing well. Antelope showed a normal increase, and, in spite of an estimated loss of 3 per cent through depredations of coyotes during

winter and spring, now number about 2,000. A few drifted out of the park near Gardiner and were killed. Many more would have suffered the same fate during the open season which has prevailed under the Montana law for the last two years had it not been for the wire fence built several years ago from the junction of the Yellowstone and Gardiner rivers to a high bluff 4 miles to the westward. Both black-tailed and white-tailed deer also showed a normal increase. The number of elk in the park is conservatively estimated at between 25,000 and 30,000, although some place the number higher. During the winter many of these elk drift down the valleys to the north and west of the park, where they suffer from want of food in regions where sheep have been grazed, or are killed by hunters and ranchers. The moose are gradually increasing on the upper Yellowstone in the southeast corner of the park and in the marshy areas along the Bechler River in the southwest. The estimated number of moose and sheep in the park in 1908 is not stated. Vigorous efforts to break up poaching were continued, but fewer arrests were made than in the previous year. Two men were convicted of hunting in the park, and a third for carrying firearms without permission.

Yosemite National Park, Cal.—The acting superintendent of the Yosemite National Park reports that game is decreasing. The changes in the boundaries of this park have thrown into the National Forest areas on the west and southwest which formed the principal winter range of the deer, and each reduction of the park has cut off another part of the winter resort for game. A new railroad has made the region more accessible and increased the number of hunters, but extensive patrolling has prevented hunting within the park. The number of grouse and mountain quail is reported as greater than last year, although still small.

Sequoia National Park, Cal.—According to the report of the acting superintendent the game in the Sequoia National Park seems to be doing well. The herd of 16 dwarf elk, placed in the park in 1905, is reported as increasing, though the present number is not stated. Deer are numerous and small bands of 4 and 5 were frequently seen during the season. Quail are plentiful, but grouse are scarce. Much trouble has been caused by mountain lions, wild cats, and coyotes, which are destroyed by rangers wherever found.

Wichita Game Refuge, Okla.—The herd of 15 buffalo donated by the New York Zoological Society and placed in the buffalo pasture in October, 1907, suffered the loss of one cow through Texas fever. Measures were promptly taken to stamp out the fever and to protect the herd from a recurrence of the disease. Two calves were born during the spring.

Grand Canyon Game Refuge, Ariz.—The boundaries of the Grand Canyon refuge were extended by a proclamation under date of June 23, 1908, to include a considerable area south of the canyon, thus making the total area of the game refuge 2,019,008 acres. In the original refuge north of the canyon at the close of the year there were 47 buffalo and cattalo, about 25 or 50 mountain sheep, and 3,000 deer. The buffalo and cattalo are the property of C. J. Jones, who is cooperating with the Department in experiments in breeding cattalo.

Fort Niobrara Military Reservation, Nebr.—By order of the President, shooting, trapping, or capture of game birds or game or other wild animals was prohibited on the Fort Niobrara Military Reservation in Nebraska. Copies of the order issued through the office of the chief quartermaster of the Department of the Missouri under date of March 5, 1908, were posted before the beginning of the breeding season, and practically made the reservation a game refuge. This reservation includes about 55,000 acres of plains and sand hills and is the home of the sharp-tailed grouse, prairie chicken, and other game.

National Bison Range, Mont.—In the act making appropriations for the Department of Agriculture for 1909, an appropriation of $30,000 was made for the purchase of not more than 12,800 acres of land on the Flathead Indian Reservation in Montana, and $10,000 additional was appropriated for fencing this area for a buffalo range. During the summer the lands were appraised and examined by representatives of the Indian Office, Forest Service, and Biological Survey, with a view to selecting the area best adapted for the purpose and making the preliminary arrangements necessary for the establishment of the proposed range. The appropriation of $40,000 was made by Congress on the understanding that no part of it should be expended for the purchase of buffalo, but that the herd should be provided by the American Bison Society. In fulfillment of its part of the contract, this society has undertaken to raise a fund of $10,000, which will enable it to place upon the range, as soon as it is ready, a herd of not less than 40 buffalo.

Bird reservations.—Eleven new bird reservations were created by Executive order during the year, making a total of 25. Of the new reservations 7 are located in Florida, 1 in North Dakota, 2 in Oregon, and 1 in Wyoming. These reservations were established on the following dates: Mosquito Inlet Reservation, on the east coast of Florida, near Daytona, February 24; Tortugas Keys, near Key West, Fla., April 6; Key West, Fla., August 8; Pine Island, near the mouth of the Caloosahatchee River, Florida, September 15; Palma Sola, south of Tampa, Fla., September 26; Matlacha Pass and Island Bay, Florida, also near the Caloosahatchee River, September 26 and October 23; Chase Lake, Stutsman County, N. Dak., August 28; Klamath and Malheur Lakes, in southern Oregon, August 8 and 18; and Loch-Katrine, in the Big Horn Basin, Wyoming, October 26.

STATE GAME PRESERVES.

State game preserves have been established in Massachusetts, Connecticut, New York, Pennsylvania, Indiana, Illinois, Minnesota, Kansas, Wyoming, California, and Washington. These reserves vary greatly in number, size, and purpose. In New York and Michigan hunting is permitted during the open season, but in the other States the reserves are maintained as refuges or sanctuaries, and in Massachusetts, Illinois, Kansas, and California some of them are maintained solely for the purpose of propagating pheasants and other game birds. These latter are of special interest, but they do not by any means represent the only efforts to restock the State with game. Besides carrying on their regular work of issuing licenses and enforcing the laws, several of the State game commissions have devoted their energies to special investigations and to restocking covers by introducing or raising birds for distribution.

In California the board of fish commissioners has imported several hundred Hungarian partridges and distributed them at a number of points in the State. Late in the year a site for a game farm was selected near Haywards, and preparations were made for raising game on an extended scale. Under an act passed in 1907 several State game preserves were established on private lands, 160 acres or more in extent. In Connecticut also the game officials have devoted their attention to introduction of game birds, and owing to the scarcity of quail have confined their efforts mainly to the distribution of Hungarian partridges, though a small number of pheasants were liberated in different parts of the State. In Colorado the commissioner has been interested in stocking the State with pheasants, in securing a record of the number of deer shipped, and in doing everything possible to increase the stock of mountain sheep and antelope in the State. In Illinois the efforts of the commissioner have been chiefly directed toward the propagation of pheasants on the State game farm of about 400 acres near Springfield. About 7,000 pheasants and 20,000 eggs were distributed during the year. Nearly 1,500 Hungarian partridges were added to the stock at the farm. The Indiana commissioner continued his plan of establishing preserves by making contracts with farmers owning contiguous lands, and stocking each preserve of 4,000 acres or more with game birds, chiefly Hungarian partridges, but in part pheasants. This system is one of the most novel and ingenious thus far suggested, and promises to attain results of far-reaching importance. In Kansas the commissioner has imported Hungarian partridges in large numbers and has made efforts to stock the State with these birds and also with pheasants. In Massachusetts investigations begun several years ago by the commissioners of fisheries and game have been continued. These include propagation of native game birds, study of diseases to which such birds are subject, effect of the introduction of ringneck pheasants, and the interrelations between foxes and native game birds, particularly in the western and central parts of the State, where fox hunting is popular. In Minnesota 230 pheasants were raised and distributed. In Nebraska, the chief game warden purchased for liberation two or three hundred Hungarian partridges with funds supplied by sportsmen. The New Jersey commission purchased and liberated throughout the State 441 English ringneck pheasants, and made arrangements to secure 1,000 more for distribution. In Washington several of the county game wardens utilized receipts from hunting licenses to purchase pheasants and Hungarian partridges for liberation or pheasant eggs for distribution in their respective counties.

PRIVATE GAME PRESERVES.

The interest in private game preserves continues to increase, and a number of such preserves have been established in various parts of the country. When used for the propagation of game and not merely for shooting purposes, private preserves benefit not only their owners, but also the general public, as they become centers from which game naturally overflows to other places. Opposition to the private preserve, particularly to ducking preserves used only for shooting, has developed in

several States and in a few instances has reached an acute stage. Recently considerable opposition has been manifested to one of the preserves on Newport Bay, in Southern California, and to several of the ducking preserves along the Illinois River. In the effort to protect their property, the Illinois clubs have recently resorted to injunction, and one of the clubs, controlled by nonresident members, has obtained an order from the Federal court enjoining certain fishermen and hunters from trespassing on the overflowed lands belonging to the club.

IMPORTATION OF BIRDS AND MAMMALS.

The chief interest in the importations of the year centered, as in 1907, in the gray or Hungarian partridge. Of these birds nearly 10,000 were brought in as against 5,205 the previous year. Pheasants of various kinds numbered 3,187, a decrease of 1,779 in the number imported the previous year. Of the pheasants 300 were English, 244 Hungarian, 8 Chinese ringnecks, and 80 true Mongolian. Two of the rare Siamese pheasants, 2 Sultan, 16 Prince of Wales, and 14 Formosa pheasants were among those imported for aviary purposes. The rapid increase in the number of Mongolian pheasants from 3 in 1906 and 24 in 1907 to 80 in 1908 is of special interest on account of the promise this bird gives of becoming an important game bird in the immediate future. The Prince of Wales pheasant, still a rare bird, is also a promising species which is destined to play an important part in the game coverts in the United States. Among the miscellaneous game birds brought in were 52 rosy-billed ducks and 200 European quail. The latter birds are migratory and experience has shown that it is futile to attempt their acclimatization in this country. The number of game birds of all kinds imported was 18,906, as compared with 11,422 in 1907.

The importation of cage birds showed a slight decrease. The number of canaries was 317,153, a decrease of about 35,000 from the importations of 1907. Miscellaneous cage birds, chiefly parrots, finches, and weaver birds, were entered to the number of 48,190, as compared with 47,816 the previous year, an increase of only 374. The total number of birds imported during the year was 384,249, as compared with 411,802 in 1907.

The number of animals other than camels, ruminants, horses, and swine, was 1,987 as against 791, or more than twice the number of the previous year. The consignments included one of 420 monkeys; and another of 120 Hungarian hares, imported not for liberation but for crossing with Belgian hares.

Eggs of game birds imported for propagation numbered 4,530, a decrease of 1,260. Of this number 3,000 eggs of English pheasants and 1,000 eggs of mallard ducks were imported for a game preserve in North Carolina.

Several species, the importation of which is prohibited, were denied entry during the year or were discovered after passing the custom house. In January two mongooses were refused entry at New York and were returned to Bremen. A few months later a mongoose, which had evidently been smuggled in and had escaped, was killed on Cape Cod, and its existence first became known when it was submitted for identification; and in December a flying fox, which had been imported from the Philippines several years before, was discovered in Washington, where it was being used for advertising purposes.

NONGAME BIRDS.

The protection of nongame birds is made the special work of the Audubon societies, both of the State organizations and the National association. During the year new State Audubon societies were organized in Arizona, Kansas, and Virginia, thus making a total of 42 States in which such societies have been founded. No additions were made to the list of 39 States which have adopted the model law for the protection of nongame birds. The State organizations have continued their activity, mainly along educational lines, distributing publications, arranging lectures, holding public meetings, and maintaining traveling libraries. Considerable attention has been given also to securing or maintaining good legislation. The Oregon society conducted an investigation of the bird colonies in the interior of the State, from which resulted the establishment of two large and important Federal bird reservations. In North Carolina and South Carolina the State Audubon societies, which have all the powers of game commissions, have been actively engaged in the enforcement of the game laws. Much work has been done in the schools by organization of bird protective societies among the pupils and by securing and arranging Bird Day celebrations. The campaign against the wearing of bird plumage has been continued, particularly among State federations of women's clubs. The importance of the educational work of these State societies can hardly be overestimated.

In its efforts for more effective bird protection the National Association of Audubon Societies actively continued its work along educational lines by distributing publications and placing special lecturers in the field, particularly in New England, in the South, and on the Pacific coast. In its legislative work it took an active part in securing better protection for shore birds in Rhode Island and the woodcock in New York, as well as aiding in the passage of several important measures in Massachusetts. In its warden work it placed men in charge of many breeding colonies of birds on the Atlantic, Gulf, and Pacific coasts, and also in the interior. In this work, besides supporting several bird reservations of its own, it cooperates with the Department of Agriculture in maintaining the Federal bird reservations. In all, the National association employed during the year 52 wardens in 14 States, as follows: Florida 6, Louisiana 6, Maine 15, Massachusetts 1, Michigan 2, Minnesota 1, New Jersey 2, New York 2, North Dakota 1, Oregon 1, South Carolina 1, Texas 1, Virginia 7, and Washington 6.

ADMINISTRATION AND ENFORCEMENT OF GAME LAWS.

ADMINISTRATION.—Interest in the administration of the game laws centered in the South, particularly in Alabama, Louisiana, South Carolina, and Texas—three of which States completed the first full year under newly organized warden service. Louisiana was added to the list of States in which game protection is in charge of general officers, making a total of 40 States which now have game commissions or wardens. A board of three commissioners, representing the eastern, central, and western sections of the State, with headquarters at New Orleans, was appointed in July, and a completely equipped warden service was organized before the opening of the hunting season.

In California a change was made in the board of fish commissioners, and a local office for the southern part of the State was established at Los Angeles. Changes in the personnel of the warden office were also made in Maryland, Massachusetts, New Jersey, Oklahoma, Oregon, Pennsylvania, and Rhode Island. During the year several deputy wardens lost their lives in the discharge of their duties—two in Michigan by drowning or exposure, one in Montana while attempting to arrest some Indians, and one in Florida and one in South Carolina as the result of foul play.

ENFORCEMENT.—In the enforcement of the game laws heavy penalties were imposed in many cases. Fines of $100 or more were assessed by the courts of California, Colorado, Connecticut, Illinois, Iowa, Louisiana, Maine, Massachusetts, Michigan, Minnesota, New York, Oklahoma, Oregon, Pennsylvania, Vermont, and West Virginia. For failure to secure the required license and to conform with other provisions of the game laws, eight prominent citizens of Alabama were arrested while hunting in Louisiana and fined $800 and costs, or a total of $970. Illegal shipment of game from the State was punished in Illinois by a fine of $675 and twenty-five days in the county jail, and in West Virginia by a fine of $500, while in Oklahoma a fine of $300 was imposed for an attempt to carry 300 pounds of dressed quail out of the State in a trunk.

Killing big game during the close season was severely dealt with in several cases: In Colorado a fine of $500 and costs was imposed for killing a mountain sheep; in Maine for the illegal killing of a moose $535 in one case and in another $500 and costs, or three months in jail in default of payment; in Michigan two men found killing game out of season were fined $100 and costs each, or a total of $250; and in New York shooting ducks in the spring on Long Island resulted in a fine of $100 and costs. Some large penalties were imposed for sale or possession out of season and for a few miscellaneous offenses. In Pennsylvania two men who offered deer hides and venison for sale contrary to law were fined $325. A resident of Ruthven, Iowa, who had ducks in his refrigerator out of season, was fined $260, notwithstanding his plea that the birds were left there without his knowledge. In Connecticut possession of more than the lawful number of partridges and the illegal transportation of game caused the imposition of three fines of $100, $147, and $190, respectively. In New York a fine of $200 was imposed for allowing dogs to run at large in the mountains near Clifton, St. Lawrence County. In California a collector who had secured for a foreign museum a number of game and other birds without permit was arrested and fined $150 and the specimens were confiscated and donated to the Academy of Sciences in San Francisco. Finally, it should be noted that for violations of the laws protecting deer, there have been imposed during the last two years at least three fines of $100 each in Connecticut, and fourteen of the same amount in Vermont.

In spite of the active enforcement of the game laws in some States, experience of the year has demonstrated more clearly than ever certain weaknesses in administration, and has shown some of the dangers to which game protection funds are exposed. Nothing is more obvious than the failure in enforcement of the game laws where reliance is placed chiefly on local peace officers or on officers serving without adequate

remuneration. Very little has been accomplished in States where the warden is appointed for only two years, and is changed at the end of every term, as this provides for the retirement of each incumbent as soon as he becomes well acquainted with the duties of his office. Dissatisfaction has arisen in States in which no provision is made for publishing regular reports on the warden service, or in which the publication of such reports has been unduly delayed, so that the public has had no means of knowing what has been done or what the service needs. The value of the warden's report as a protection, both to the official and to the people, has seldom been more clearly demonstrated. New difficulties and dangers in the administration of game protection funds have also become apparent. The comparative ease with which the game protection fund is collected and the broad powers granted to the game commissioners or wardens in some States have been the subject of more or less severe criticism. Complaint has been made that receipts from hunting licenses have been expended for purposes other than that for which they were intended, and that in some cases deputies have been active in directions other than the protection of game. These criticisms show clearly the importance of surrounding game protection funds with further safeguards.

LEGISLATION.

Game protection was mentioned in four of the governor's messages, and in two States (Louisiana and New York) the recommendations were acted upon favorably by the legislature. The governor of Louisiana recommended the publication of the game and fish laws in pamphlet form, and the enactment of a resident hunting license. The governor of Maryland favored restricting the duties of the State warden to game, leaving the protection of fish to the fish commissioners. The governor of New York recommended a careful revision of the game law and the adoption of a complete license law with reasonable fees for residents, nonresidents, and aliens. The governor of Ohio, likewise, indorsed the enactment of a resident license.

The amount of actual legislation enacted during the year was remarkably small and included only one Federal law of general interest. This act—a new game law for Alaska—divided the Territory into two game districts, established nonresident hunting licenses with fees of $50 for citizens of the United States and $100 for aliens, and resident and nonresident shipping licenses at rates ranging from $5 to $150, and authorized the governor to issue licenses, appoint wardens, and establish regulations for the registration and compensation of guides.

Regular sessions of the legislatures were held in fourteen States—three each in the New England and the Middle States, five in the Southern States, and three in the Middle West. Special sessions were also held in Kansas and North Carolina. Game bills were under consideration in all of these States, and in all except three amendments to the game laws were enacted. Exclusive of appropriation bills the total number of new game laws was 68—one-half of them local measures—distributed as follows:

Alaska	1	North Carolina	7
Georgia	1	Ohio	2
Kansas	1	Oklahoma	0
Kentucky	0	Rhode Island	2
Louisiana	2	South Carolina	4
Maryland	19	Vermont	8
Massachusetts	8	Virginia	4
Mississippi	0		
New Jersey	7	Total	68
New York	2		

Seven new game laws were also enacted in Canada—one each in Alberta, British Columbia, Manitoba, Newfoundland, and Nova Scotia, and two in Quebec. New codes were adopted by New York, Ohio, and Nova Scotia, in which important modifications in existing laws were incorporated. Among the novel features in legislation were the Vermont act authorizing the governor to suspend the open season in times of drought, when the use of firearms in the woods is likely to cause forest fires; the Quebec provisions making lumbermen responsible for violations of the game law by their employees, and authorizing the lieutenant-governor in council to fix fees for the incorporation of fish and game organizations; and the British Columbia act, authorizing the lieutenant-governor to set aside tracts of Crown lands for game reserves. Among the important changes in seasons were: The expiration of the close season of four years for deer in the central and southeastern parts of the Lower Peninsula of Michigan, the prohibition of spring shooting of waterfowl in northern New Jersey, and shore birds in Rhode Island, the abolition of summer woodcock shooting in New Jersey, and the local seasons for rabbits in New York, Virginia, and Newfoundland. Besides these changes close seasons were established in Massachusetts for squirrels, in New York for

wood ducks, and in Vermont for two years for quail, four years for pheasants and English partridges, and six years for upland plover. In Vermont the open season for deer in 1908 was postponed, on account of drought, from the last week in October until the second week in November, and the deer law was changed by the enactment of a so-called "doe bill," which permits does as well as bucks to be killed, and thus removes the protection which the former have had in that State for nearly forty years. Restrictions on marketing game were increased in several States, especially in Louisiana, Ohio, Virginia, and Newfoundland, Ohio for the first time cutting off the sale of all game, and Virginia of all upland game birds. Changes were made in bag limits by reducing the limit in New York on quail, grouse, and woodcock, and in Ohio on practically all game birds except ducks, and increasing the limit on woodcock in Nova Scotia.

In view of the comparatively small amount of legislation the progress in extending the license system was remarkable. Resident hunting licenses were established for the first time in Louisiana, Massachusetts, New York, Vermont, and Nova Scotia, alien licenses in Alaska, New Jersey, and New York, and a nonresident license in Alaska, while the fees for nonresidents hunting in Louisiana, New York, and British Columbia were increased. South Carolina reestablished its county license in addition to the State license. Important changes, tending to improve enforcement, were enacted in the laws of Alaska, Louisiana, and Nova Scotia. In Louisiana a board of three commissioners was established with headquarters at New Orleans, and in Nova Scotia a board of three members was also appointed to take over the duties previously intrusted to the Game and Inland Fishery Protection Society. The new Alaska game law authorized the appointment of wardens by the governor, but no appropriation was made for payment of their salaries. In Virginia the duties of game wardens were extended to include protection of fish.

DECISIONS OF THE COURTS.

A dozen or more decisions involving the construction of the game laws were rendered by the higher State courts and one (New York ex rel. Silz *v.* Hesterberg, 211 U. S., 31) by the Supreme Court of the United States. The Silz decision is the first relating to game which has been rendered by the Supreme Court for twelve years. It sustained the constitutional right of the State to prohibit possession and sale of imported game during the close season, and has finally settled a question which has been before the courts in a number of States for nearly thirty years. The other questions passed on by the State courts during the year related to sale, both of native and imported game, hunting rights, hunting with dogs, hunting on Sunday, hunting without written permission, definition of open seasons, and disposition of fines. None of these questions was particularly novel, except that relating to hunting without written permission. In at least two cases the decisions were at variance with the general practice or with the majority of previous decisions on the same question, and in one a serious defect in the bonding features of the New York law was brought to light. In Alabama two decisions, Barclay *v.* State (47 S., 75) and Hyde *v.* State (46 S., 489), were rendered on the constitutionality of the provisions requiring hunters to obtain written permission of landowners to hunt on their lands, and in both cases the constitutionality of the new game law was sustained. In Michigan the rights of hunting clubs were passed upon in Ainsworth et al. *v.* Munoskong Hunting and Fishing Club (116 N. W., 992), and St. Helen Shooting Club *v.* Barber (114 N. W., 399).

In Mississippi the question of the right of county boards of supervisors to make regulations under the game law was raised. The court held in State *v.* Buckingham (47 S., 501) that supervisors could not make it an offense for nonresident members of a club to shoot game on lands which they leased, owing to a general statute which authorized landowners and their nonresident relatives and friends to hunt on their lands during the open season.

In New York two decisions were handed down by the appellate division of the supreme court. In People *v.* Martin (107 N. Y. S., 1076) a penalty was imposed for the possession during close season of 45 imported black game and certain native game birds. In People *v.* White (108 N. Y. S., 212), involving the question of hunting deer with dogs, the court held that each offender was separately liable to the penalty, whether actually engaged or aiding in the violation. The case of People *v.* Weinstock (86 N. E., 547), which had been decided the year before by the same court in favor of the State, was carried to the court of appeals. This case involved the sale of a dozen grouse during the open season by a dealer who had not given the bond required by the game law. The decision in this case exposed a defect in the bonding provision of the law, the court holding that there was no penalty which could be enforced for failure to give bond for the sale of such birds in open season. The judgments of the lower courts were, therefore, reversed and the complaint dismissed.

In Ohio the construction of the definition of open season arose in the case of State *v.* Elson (83 N. E., 904). The defendant was arrested for killing quail on December 5, and was tried and convicted before a justice of the peace, under a statute which prohibits the killing of quail "except from the 15th day of November to the 5th day of December." The case was appealed and when it reached the supreme court that court declared that in computing the time of the open season the first date should be excluded and the last date included.[a]

In Oregon the supreme court held in State *v.* Fisher (98 Pac., 713) that under a statute prohibiting possession of deer in close season, taken in connection with another statute by which proof of possession at such time is made prima facie evidence of illegal killing, mere possession of deer in close season is not conclusive evidence that such possession was unlawful. This decision is in line with the case of State *v.* Bucknam in Maine (34 Atl., 170) and directly opposed to the decision of the supreme court of Indiana in Smith *v.* State (58 N. E., 1044).

In Tennessee the supreme court in State *v.* Sexton (114 S. W., 494) sustained the Sunday hunting provision and passed on the proper construction of the game law in certain matters of procedure.

In West Virginia the supreme court in State *v.* Parkins (61 S. E., 337) finally disposed of the question whether a statute providing that fines for violation of the game laws should be paid to deputies was in conflict with the constitutional provision that the net proceeds of all forfeitures and fines shall be appropriated for the support of free schools. Ever since the establishment of the warden system in the State receipts from fines have furnished the chief source of the fund from which wardens were paid, but the court held that the provision authorizing such payment was unconstitutional. Apparently this was the only case decided during the year in which a provision of the game law was declared unconstitutional by the higher courts of any State.

Two decisions in the lower courts also merit mention. In Pennsylvania the court of quarter sessions of Delaware County in the case of Commonwealth *v.* McCoombs declared the statute prohibiting the use of automatic guns in killing game unconstitutional on the ground that it was a discrimination against makers of automatic guns and deprived them of the equal protection of the laws guaranteed by the Constitution of the State and of the United States.

In Texas the fifty-eighth district court also declared the provision of the Texas game law prohibiting sale of ducks illegal and void, a decision which for a time hampered the enforcement of the game law in that State. An appeal, however, was taken to the higher court and shortly after the close of the year the decision was reversed by the court of criminal appeals (Ex parte Blardone, 115 S. W., 838).

REVIEW OF ROAD LAWS ENACTED IN 1908.

Compiled in the Office of Public Roads.

Only 14 of the State legislatures were in session in 1908, but notwithstanding this fact a large number of bills were passed relating to the public roads, Virginia leading in this respect with 48 bills. The legislature of Maryland enacted 26 bills, Ohio 15, Vermont 12, New Jersey 12, South Carolina 9, New York and Massachusetts each 8, Georgia 6, Mississippi and Kentucky each 5, and Rhode Island 2, making a total of 156. A large proportion of this legislation was of a special character relating to individual counties, and is not referred to in the digest by States given below.

GEORGIA.—Act No. 452 changes the minimum age limit for those liable to road duty from 21 to 18 years.

A new convict labor law was enacted (L. 1908, No. 4, extra sess.), providing that all male felony convicts, except such as are now required by law to be kept at the State farm, may be employed by the several counties and municipalities upon the public roads, bridges, or other public works. On or before the 10th day of February annually, the prison commission shall communicate with the county authorities and ascertain the counties desiring to use convict labor upon their public roads. The convicts shall be apportioned among the counties according to population, and may be awarded to counties other than the one in which the conviction was had. One county may, upon the approval of the prison commission, deliver its quota of convicts to another county, to be used on the roads and bridges thereof, the counties so receiving such convicts to have the right to compensate the county from which they came, with work upon its roads, or by the exchange of an equal number of convicts.

[a] This is an interesting decision in that it is contrary to the usual practice. In fact, two States (New York and Vermont) have provided by statute that the season shall include the first date, but not the last.

The prison commission is authorized, when in funds, to equip and organize road-working forces, to be used for work on roads and bridges in counties not using their convicts under the provisions of this act, when so requested by the authorities thereof, the work to be done as nearly as practicable in proportion to the convicts which would have been assigned to each county in case the county had worked its convicts. The county in which convicts are worked shall pay the expenses thereof, including maintenance of equipment and all material required for the work done. If all convicts are not disposed of in complying with the preceding provisions, they may be placed in counties desiring to use them in excess of their quota. If after the counties have been supplied there shall still remain any convicts undisposed of, then the privileges conferred upon counties herein shall be extended to municipalities, but they shall pay $100 per capita annually for each convict.

Any county may purchase or rent and maintain a farm and cultivate same with convict labor in connection with working its convicts on its public roads and bridges, all products to be used for the support of the convicts and of county institutions, and for improving its roads and bridges. The same may be done for a like purpose by the prison commission on behalf of the State.

The net proceeds from the disposition of convicts to municipalities or otherwise may be used by the prison commission in working convicts upon the public roads or works of counties not electing to utilize their allotment of convicts; and in case said commission shall elect not to work the roads in any of such counties, then their pro rata of said funds shall be paid into their respective treasuries to be used for road purposes only.

Not to exceed four supervisors may be employed by said prison commission, who shall visit the various counties, inspect the convicts and their work, and perform such other duties as may be required of them. If practicable, civil engineers shall be chosen, and the salaries shall not exceed $150 per month and traveling expenses. The commission shall also appoint necessary wardens and guards, the pay of a guard not to exceed $50 and that of a warden $100 per month.

KENTUCKY.—The law relating to poll taxes was so amended (ch. 26) that the tax of $1.50 or less levied on each male 21 years of age may be applied to the maintenance of roads in the respective counties.

An amendment to the constitution was voted by the legislature (ch. 36), to be submitted to the people at the next election, providing that the credit of the State may be given to any county for public-road purposes, and that any county may incur indebtedness not exceeding 5 per cent of its taxable property for public-road purposes, provided such additional indebtedness is approved by the voters of the county at a special election and that an additional tax of not to exceed 20 cents on the hundred dollars shall be levied to pay the interest and provide a sinking fund.

The supervisors, or if there be none, the county judge (ch. 42), in counties working their roads by taxation, may receive bids and award to the lowest bidder the keeping in repair of all roads, and the building and repairing of bridges and culverts in said county for a term of not less than one nor more than four years.

MARYLAND.—Article 91 of the code of 1904 was amended (ch. 141) by providing that the governor shall appoint three citizens of the State and designate two more from the Maryland geological and economic survey, who, with the governor ex officio, shall constitute the "State roads commission." Each member, except the governor, the chairman, and the two members from the Maryland geological and economic survey, shall receive a salary of $2,000 per annum. The chairman shall receive $2,500 per annum. A secretary shall be appointed at a salary of not to exceed $1,800 annually. The commission is authorized to appoint engineering and other assistants and fix their compensation.

The commission is directed to select, construct, and maintain a general system of improved State roads through all the counties of the State, the selection to be made by May 1, 1909. The commission may make all necessary preliminary surveys, estimates, plans, specifications, etc., and shall adopt such method of construction or improvement as it shall think best, and is authorized to condemn and acquire any private road or private property or rights of drainage for public use.

Work to cost over $500 must be let to contract, after advertisement, to the lowest bidder. Roads constructed under this act shall be kept in repair by the commission, but the counties shall have police jurisdiction.

The commission is required to complete a general system of roads within seven years from July 1, 1908, and the sum of $5,000,000 is appropriated therefor, not to exceed $1,000,000 to be expended in any one year. Three and one-half per cent bonds of the State may be issued to raise said amount. The proceeds are to be expended in the various counties in proportion to the road mileage therein, but this does not mean that

a certain amount shall be spent in each county each year, but to provide eventually a fair distribution of the funds.

To meet the interest and create a sinking fund, the county commissioners of the State and the mayor and city council of Baltimore shall levy the State taxes for 1909 at 2 cents on each $100 of assessed valuation; 1910, 3½ cents; 1911, 4½ cents; 1912, 5½ cents; 1913 and annually thereafter, 6 cents.

MASSACHUSETTS.—An appropriation of $36,300 was made for the salaries and expenses of the Massachusetts highway commission; $30,000 for expenses in the registration of motor vehicles and licensing operators thereof; $7,000 for suppressing the gipsy and brown-tail moths on State highways; and $100,000 for maintenance of State highways. (1908, ch. 212.)

Section 17 of the act creating the Massachusetts highway commission was amended so that said commission shall not allot in any one year to any town of less than $1,000,000 assessed valuation, and which makes no appropriation under said section as amended, more than 40 per cent of its average annual appropriations for highway purposes for the preceding five years, unless said average annual appropriation shall not exceed $1,000, in which case $400 may be allotted to such town. (1908, ch. 279.)

A penalty of from $5 to $100 is provided against anyone who without authority cuts down, trims, or removes any tree, shrub, or growth within the limits of State highways. (1908, ch. 297.)

All fees arising from the regulation and registration of motor vehicles, after the expenses of enforcing such regulation and registration are paid, shall be expended for the maintenance of State highways, and the counties shall not be required to repay the State any part of such expenditures. (1908, ch. 642.)

Any member of the Massachusetts highway commission, in administering the laws and regulations relative to automobiles and motor cycles, may summon witnesses duces tecum, and take depositions. Said commission may appoint not to exceed four investigators and examiners, and may remove them for cause, said investigators and examiners to exercise throughout the State, with respect to the enforcement of all laws relative to motor vehicles, all the powers of constables and of police officers and watchmen, and may serve all processes lawfully issued by said commission. Said commission shall investigate automobile and motor cycle accidents, and if any person is killed by any such accident, shall forthwith suspend the license of the operator, and shall revoke such license if it shall appear on investigation that said operator was at fault. A license so revoked shall not be renewed within six months. The registration fee is $2 for each motor cycle, $5 for each automobile, and $2 for each automobile to be operated for hire. (1908, ch. 648.)

MISSISSIPPI.—Chapter 109 abolishes the leasing of convicts and authorizes the boards of supervisors to work such convicts on a county farm, or farms, or on the public roads or other public works, or to keep them in jail. Municipalities may so work persons convicted of violating their ordinances. Sexes and races are to be separated and worked separately. No convicts shall be let to contractors. A number of sections of the code of 1906 are repealed.

NEW JERSEY.—The salary of the supervisor to assist the State commissioner of public roads is fixed at $3,600, and he is required to be a competent civil engineer. (L. 1908, ch. 88.)

The act providing for the permanent improvement of public roads in this State (revision of 1905) is amended so that when two-thirds of the owners of the land and real estate fronting on any public road or section thereof shall petition the board of chosen freeholders for improvement of same, setting forth that the township or other municipality in which the same shall lie has appropriated 10 per cent of the estimated cost of same, said board shall make such improvement, provided that the road to be so improved shall be at least 1 mile in length or be an extension of or connection with some other improved road or street. (L. 1908, ch. 53.)

A further supplement to an act conferring certain powers on the board of chosen freeholders of any of the several counties of this State, approved April 7, 1888, is enacted (L. 1908, ch. 69), authorizing said board to reenforce, re-lay, reconstruct, or rebuild any portion of any road improved and maintained under the provisions of the act to which this is a supplement, or the acts supplementary thereto and amendatory thereof. For raising funds therefor bonds of the county may be issued, provided the total cost shall not exceed two-tenths of 1 per cent of the total assessed valuation of said county. Work to cost over $1,000 shall be let to contract.

Chapter 238, laws of 1908, vests authority in the board of chosen freeholders of counties to acquire by gift, purchase, or condemnation any real estate in the county that may be necessary for the purpose of laying out or otherwise improving any public highway under its control.

Hereafter all roads on lands owned by the State shall be constructed and maintained and all such roads heretofore constructed by the State commissioner of public roads shall be maintained at State expense. (L. 1908, ch. 295.)

The law relating to motor vehicles is amended (L. 1908, ch. 304) to make the assistant secretary of state ex officio commissioner of motor vehicles, and charge him with enforcing the laws relative thereto; and he shall appoint a chief inspector of motor vehicles, and not to exceed 10 other regular inspectors, and not to exceed 20 citizens as special inspectors, and fix the compensation of all such inspectors. The commissioner of motor vehicles shall receive $1,500 in addition to his salary as assistant secretary of state, and the chief inspector shall receive $1,500.

The registration fees shall be as follows: $3 for automobiles of 10 horsepower or less; $5 for those of from 11 to 29 horsepower; and $10 for those of 30 horsepower or over. A fee of $2 shall be paid for motor cycles, which shall include the right to operate same. Persons or corporations operating automobiles for carrying passengers, which business shall be conducted in an adjoining State, but which requires such automobile to enter this State, shall pay an annual fee of $100, and the speed of such automobiles shall not exceed 15 miles per hour, nor shall there be more than 15 such in this State at any time. Dealers or manufacturers are issued registration certificates under which may be operated five automobiles, and the fee for same shall be $5 for each automobile operated thereunder. Fees for licenses to operate automobiles are as follows: $2 to operate a machine of less than 30 horsepower, and $4 for those licensed to operate machines of over 30 horsepower.

The moneys received for such registrations, licenses, and fines shall be paid into the State treasury and appropriated annually for the repair of improved roads throughout the State, whether originally constructed by State aid or not.

New York.—An act was passed consolidating the highway laws of the State and providing for a State department of highways and for the construction and maintenance of State and county highways (L. 1908, ch. 330). The said department shall consist of three commissioners to be appointed by the governor, with the consent of the senate, for a term of six years, one of the members to be a civil engineer. The salaries shall be $6,000 for the chairman and $5,000 for the other members, in addition to traveling expenses, one of the commissioners to belong to the next largest political party. The commission is authorized to appoint deputies, secretary, clerks, etc.

The commission has control of all highways and bridges built with the aid of the State and is required to divide the State into not more than 6 divisions, each to be in charge of a division engineer.

The board of supervisors of any county is authorized to appoint a county superintendent, or if the supervisors do not appoint a superintendent, the commission shall place such county in a district with other counties and appoint a district superintendent, such superintendent to have charge of all highways and bridges in a district or county.

A superintendent of highways shall be elected for each town at the biennial town meeting, unless the town votes to have such superintendent appointed by the town board.

A system of State roads is provided for, the entire cost to be paid by the State, provided that the total expenditures therefor shall not exceed one-half of the total appropriation from the proceeds of the State bonds issued for the construction of highways.

Each township is required to pay toward the maintenance of State and county highways $50 annually for each mile or major portion of a mile of such highways therein, the State to pay the balance. Such roads located within incorporated villages shall be maintained by the board of trustees at the expense of the village.

The sum of $3,000,000 was appropriated for road improvement during the year, to be paid from the proceeds of the bond issue; $430,000 was appropriated to pay the interest on the State debt for highway improvement, $32,000 for repairing certain designated highways, $100,000 for the maintenance of improved highways, to become available January 1, 1909, and $113,375 for salaries and expenses of the State highway department January 1 to September 31, 1909. Several minor appropriations were made.

Ohio.—An act was passed providing that whenever any railroad company constructing a new railroad, or changing the location of an old one, or any proper authorities constructing a new highway, shall desire that the railroad or highway shall be so constructed as to cross at the same grade, or if it is desired to divert, change, or alter any existing public highway, a petition shall be presented by the party desiring same to the court of common pleas of the county wherein the road is located, and the other party shall be defendant, and the proceedings shall be the same as in other civil actions in said court, with the same right of appeal to the circuit court. (L. 1908, H. B. No. 922.)

The act creating the State highway department was so amended (L. 1908, H. B. No. 286) that the state highway commissioner may appoint three competent civil

engineers at a salary of $1,500 per annum and actual traveling expenses, and the salary of the assistant commissioner is increased to $1,800 per annum. Also, the State is to pay one-half the cost of highways improved under the provisions of this act, as against one-fourth heretofore. The levy by the county commissioners for the State and county road improvement fund is increased from 0.5 mill to 1 mill on the dollar. An appropriation of $440,000 was made (L. 1908, H. B. No. 1287) for State aid in road improvement.

Sections 4925 and 4926 of the Revised Statutes were amended (L. 1908, H. B. No. 456), so that only a majority of all landowners residing in the county within the bounds of any State, county, township, or turnpike road are required to petition the county commissioners for an extra tax for constructing, improving, or repairing such road, and said commissioners may levy such tax as they may think necessary after notice and full hearing, not to exceed 5 mills, on all the taxable property, real and personal, within not exceeding 1 mile on either side of such road, and in no case more than one-half of the distance from such road to any other such road running parallel or nearly parallel thereto. The said county commissioners shall appoint three freeholders of the county, resident within the bounds of said road, who shall constitute a board of road commissioners to have charge of the improvement of said road. Bonds may be issued in anticipation of the proceeds of the tax.

An act was passed (L. 1908, H. B. No. 1102) amending sections 5 and 18 of an act passed April 22, 1904, so that when a township shall vote to improve the roads therein by general taxation, the trustees thereof shall appoint three freeholders as commissioners, to serve three years, and their successors shall be appointed for like terms and in like manner until all the roads of such township are improved. Said commissioners shall designate the roads and streets to be improved, and said trustees shall levy a tax of not exceeding 6 mills on the dollar on all taxable property in said township, until all of said roads are improved.

Section 1 of an act passed April 4, 1900, was amended (L. 1908, H. B. No. 1243) so that on petition of a majority of the landowners residing within 1 mile of any public road to the county commissioners asking for the grading and improvement of such road, said commissioners may cause said improvement to be made, not less than half nor more than two-thirds of the cost thereof to be paid by the township in which same is located, and the balance to be equitably assessed against said landowners and the real estate benefited thereby.

Section 4919 of the Revised Statutes is amended and supplemented by section 4919-1 (L. 1908, H. B. No. 495), so that whenever any principal highway, or part thereof, has been destroyed by freshet or other casualty, or by reason of the large amount of traffic thereon, and the county commissioners shall think the ordinary levies authorized by law for such purposes inadequate for repair of such damages, they may levy a tax of not exceeding 0.5 of a mill on each dollar of assessed valuation of the county, to be expended under their direction. They are also required to cause all necessary repairs on all improved roads in the county, and may levy therefor a tax of not to exceed 0.3 of 1 mill on all the taxable property of the county, which levy shall be in addition to all other levies authorized by law. The materials used for such work shall be procured by contract, and the work may be performed by day labor or may be let to contract. Said commissioners may issue bonds in anticipation of the funds to arise from the above levy.

The township trustees may issue thirty-year 5 per cent bonds of the township for the purpose of making road improvements. (L. 1908, H. B. No. 1060.)

The act of April 2, 1906, relating to road districts, was amended (L. 1908, H. B. No. 533) so as to fix the term of office of district road commissioners at four years. Such road districts may issue twenty-five-year 6 per cent bonds, in a sum not to exceed $250,000, unless the taxable valuation of such district exceeds $5,000,000, in which case $25,000 more bonds may be issued for each million of assessed valuation of such district over $5,000,000. A tax of 1 mill on the dollar may be levied in such district for the purpose of keeping said roads in repair.

Sections 4637-4639 of the Revised Statutes are so amended (L. 1908, H. B. No. 1169) that benefit assessments on abutting property may be anticipated by the county commissioners, after the first installment has been paid, and sufficient money borrowed to pay the balance of the estimated cost of the improvements, and 5 per cent bonds may be issued therefor; but the total amount of such bonds outstanding at any one time shall not exceed 1 per cent of the total taxable valuation of the county.

Rhode Island.—Chapter 1157 of the public laws of 1904, relating to the licensing or registration of automobiles, and all acts inconsistent with chapter 1592, laws of 1908, are repealed by said chapter and the following new provisions enacted:

Registration fees shall be as follows: $5 for a motor vehicle other than a motor cycle, or automobile truck of 20 horsepower or less; $10 for one of over 20 and not more than 30 horsepower; $15 for one of over 30 and not more than 40 horsepower; and $25 for

one of over 40 horsepower. A fee of 50 cents is charged for motor cycles; $50 is charged for issuing to manufacturers or dealers a general registration certificate to be used on any vehicles handled by them until such vehicle is sold. A fee of 50 cents is charged for each original license to operate a motor cycle, and $1 for each original license to operate any other motor vehicle. Any nonresident of this State who shall have complied with the laws of the State or Territory of the United States in which he resides, requiring registration of owners of motor vehicles or motor cycles, may come into this State and operate under such registration for twenty days.

The maximum speed limit is 25 miles per hour. No city or town shall have power to make any ordinance respecting the speed of motor vehicles, but they may exclude them from certain roads therein and shall designate such roads by public signs: *Provided*, That such roads shall not include State roads or main highways leading from town to town.

All money collected for registration and license fees and fines under the provisions of this act shall be turned over to the general treasurer, to be used for the maintenance of state roads under the direction of the State board of public works.

South Carolina.—An act was passed conferring upon the council of any city or town of over 1,000 inhabitants the power and duty to keep in good repair all the streets, ways, and bridges within the limits of such city or town, and said council is empowered to require all male inhabitants between 18 and 50 years of age, not exempt by law, to work not exceeding four days upon such streets, ways, or bridges each year, or pay in lieu thereof not to exceed $3. (L. 1908, No. 446.)

Local acts were passed relative to road improvement and taxation in 12 counties.

Vermont.—(Session commenced October 7, 1908; adjourned January 29, 1909.) Section 3578 of the public statutes, providing for highway districts in incorporated villages is repealed. (L. 1908, No. 95.)

Section 3977 of the public statutes was so amended that the selectmen of towns shall annually cause to be cut or removed from within the limits of highways all objectionable trees and bushes. Shade and fruit trees that have been set or marked by the abutting landowners, and young trees set at proper distances, shall be preserved. This duty on State roads shall devolve on the State highway commissioner. (L. 1908, No. 96, approved January 14, 1909.)

Sections 4004 and 4005 of the public statutes are amended (L. 1908, No. 97, approved January 22, 1909) so that the State highway commissioner, with the advice and consent of the governor, shall annually appoint one supervisor for each county. All moneys appropriated by the State under the provisions of this chapter shall be expended in improving the most important roads in each town, which shall be selected by the selectmen and town road commissioners, subject to approval by the State highway commissioner, and shall be known as State roads. Towns shall keep such State roads, together with all roads heretofore improved at State expense, in good repair. No town shall receive money from the State until it has complied with all the provisions of this chapter, and all such money shall be expended by a commissioner appointed by the selectmen of each town, with approval of the State highway commissioner, but said selectmen and said State commissioner may agree upon any plan of expenditure deemed best, and these provisions apply to incorporated villages in expending money so apportioned to them.

An appropriation of $75,000 is made by the same act for permanent road improvement, which is an amendment of section 4009 of the public laws. This appropriation shall be available to cities and towns, excluding incorporated villages, as follows: When a town shall vote to raise money in excess of the amount required by law to be raised for highways, to take advantage of the provisions of this section, and the town clerk shall notify the State highway commissioner of same on or before April 1 of each year, said commissioner shall apportion to the town an equal amount from the sum above appropriated, provided the amount so voted is not less than $100 nor more than $500 in any one year.

Said act also amends section 4013 of the public statutes so that an incorporated village may, upon application to the State highway commissioner, have the services of an engineer in making plans for improving its streets and for supervision of work, under the following conditions: A village voting and expending $500 in any one year for street improvements may have such services at an expense of not to exceed $100 for the biennial term, and where $1,000 is so voted such services may be had at an expense of not exceeding $300 for the biennial term, to be paid from the fund provided in section 4009 in both instances.

Sections 4076, 4077, and 4100 of the public statutes, relating to registration of motor vehicles, were amended so that annual registration is required, and application for such registration shall be to the secretary of state. Such application must be accompanied by a fee of $1 for each horsepower of such automobile or motor vehicle.

The second registration fee of any such motor vehicle shall be but 75 per cent of the first fee, and the third and each successive fee shall be but 50 per cent of the first one. All fees recovered by chapter 176 of the general statutes as amended by this act, less expenses incurred in connection therewith, shall be applied to a separate fund to be called the "maintenance fund," to be expended in the maintenance of the main thoroughfares and State roads, under the direction of the State highway commissioner, in the several counties in proportion to the amount received therefrom. (L. 1908, No. 99, approved January 28, 1909.)

A resident of another State or country who has complied with the laws thereof requiring the registration of automobiles shall not be required to pay registration fee for operating an automobile or motor vehicle in this State for not to exceed ten days, provided such State or country grants like privileges to residents of this State; and if such person shall operate such machine in this State more than ten days but not exceeding sixty days he shall pay a license fee of $3 for each automobile of 20 horsepower or less, $6 for each one exceeding 20 and less than 40 horsepower, and $10 for each one of more than 40 horsepower. And if he shall operate such automobile for more than sixty days, he shall be subject to the same fees as residents, the amount already paid to be deducted therefrom. (L. 1908, No. 100, approved January 28, 1909.)

The maximum speed limit of automobiles is fixed at 25 miles an hour outside a city or incorporated village, and not to exceed 10 miles within an incorporated city or village or across any bridge of more than 50 feet span; but selectmen of towns or the proper officials of a city or incorporated village may make special regulations as to the speed on narrow or dangerous roads or ways, which may be appealed to the State highway commission. (L. 1908, No. 101, approved January 28, 1909.)

VIRGINIA.—Chapter 28 so amends the convict-labor law that felony convicts sentenced to imprisonment for a term of five years may be sentenced to work on the roads, as against two years heretofore.

The State-aid law is so amended (L. 1908, chs. 76 and 131) that the local road authorities in making their second application for State aid after applying for an engineer shall agree that the county and smaller road divisions thereof will bear as a county charge in the first instance 50 per cent of the expense of such road improvement, which improvement shall be of telford, gravel, macadam, sand-clay, or other form of road construction best suited to the needs of the vicinity and consistent with economy. Said State highway commissioner, after receipt of said second application, shall advertise for bids to do such work, and the local road authorities shall let the contract to the lowest responsible bidder, or may reject any and all bids. Such work shall be done under actual supervision of the State highway commissioner, and partial payments may be made not to exceed 90 per cent of contract price before the work has been completed and accepted.

Five per cent of the total sum appropriated by the State and raised locally in accordance herewith may be reserved by the State highway commissioner to enable him to employ necessary assistants; and the balance of such State-aid money shall each year be apportioned among all the counties in proportion to the total amount of State taxes paid into the treasury from all sources the next preceding fiscal year, and if any county shall not apply for its apportionment by the 1st day of March the same shall be apportioned in like manner as before to the other counties having theretofore made application for a greater sum than their apportionments, respectively.

Any county whose share of said annual apportionment of State aid shall not exceed $2,500 shall be entitled to receive the same in payment of 50 per cent of the expense of permanent bridge building in such county according to plans and specifications made or approved by the State highway commissioner, the county to bear the other 50 per cent of such expense.

Where a State convict road force is furnished to any county in any year, such county shall not be entitled to receive State aid in money under this act.

An annual appropriation of $250,000 is made for carrying out the provisions of this act, to commence March 1, 1909. (L. 1908, ch. 76, ss. 1–10.)

Counties may issue 34-year 6 per cent bonds, after an election held therefor, for making road improvements in any magisterial district therein, such election to be held in the same manner as other elections, the amount of such bonds not to exceed 10 per cent of the total taxable values at the time in said magisterial district, and a tax shall be levied on the property of said district to pay the interest of said bonds and create a sinking fund for their discharge. No such election shall be held oftener than once in two years. (L. 1908, ch. 70.)

The convict-labor law was amended so that all persons sentenced to work on the public roads shall be allowed credit for good behavior on their sentences, and any person so sentenced until cost or fine be paid shall be allowed a credit thereon of 50 cents per day for such days as he shall so labor, and not more than six months of such work shall be required in any case solely for failure to pay fine or costs. (L. 1908, ch. 354.)

STATISTICS OF THE PRINCIPAL CROPS.

[Figures furnished by the Bureau of Statistics, Department of Agriculture, except where otherwise stated. All prices on gold basis.]

CORN.

Corn crop of countries named, 1903–1907.

Country.	1903.	1904.	1905.	1906.	1907.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	2,244,177,000	2,467,481,000	2,707,994,000	2,927,416,000	2,592,320,000
Canada:					
Ontario	30,211,000	20,880,000	21,582,000	24,745,000	22,949,000
Quebec					1,420,000
Mexico	90,879,000	88,131,	85,000,000	70,000,000	70,000,000
Total North America	2,365,267,000	2,576,492,000	2,814,576,000	3,022,161,000	2,686,689,000
SOUTH AMERICA.					
Argentina	148,948,000	175,189,000	140,708,000	194,912,000	71,768,000
Chile	1,118,000	1,477,000	1,244,000	840,000	1,500,000
Uruguay	5,289,000	3,035,000	4,417,000	3,236,000	5,359,000
Total South America	155,355,000	179,701,000	146,369,000	198,988,000	78,627,000
EUROPE.					
Austria-Hungary:					
Austria	16,056,000	12,529,000	17,293,000	18,177,000	16,599,000
Hungary proper	135,751,000	59,400,000	94,045,000	162,973,000	155,616,000
Croatia-Slavonia	23,776,000	11,364,000	18,385,000	25,589,000	17,934,000
Bosnia-Herzegovina	8,411,000	6,464,000	9,584,000	8,936,000	6,468,000
Total Austria-Hungary	183,994,000	89,757,000	139,307,000	215,675,000	196,617,000
Bulgaria	22,836,000	12,758,000	18,141,000	27,780,000	12,000,000
France	25,360,000	19,482,000	24,030,000	14,581,000	24,027,000
Italy	88,990,000	90,545,000	97,265,000	93,008,000	88,428,000
Portugal	14,000,000	15,000,000	15,000,000	11,023,000	9,000,000
Roumania	80,272,000	19,598,000	59,275,000	130,546,000	57,576,000
Russia:					
Russia proper	40,397,000	18,956,000	22,533,000	59,320,000	41,903,000
Poland		13,000			1,000
Northern Caucasia	10,067,000	6,951,000	10,798,000	11,181,000	8,860,000
Total Russia (European)	50,464,000	25,920,000	33,331,000	70,501,000	50,764,000
Servia	19,479,000	9,498,000	21,431,000	27,786,000	17,691,000
Spain	18,759,000	21,300,000	31,880,000	18,714,000	25,372,000
Total Europe	504,154,000	303,858,000	439,660,000	609,614,000	481,475,000
AFRICA.					
Algeria	435,000	391,000	490,000	544,000	402,000
Cape of Good Hope	3,500,000	3,502,000	2,500,000	3,200,000	3,550,000
Egypt	30,000,000	30,000,000	30,000,000	30,000,000	35,000,000
Natal	1,997,000	5,282,000	4,822,000	3,845,000	3,300,000
Sudan (Anglo-Egyptian)	184,000	189,000	320,000	300,000	300,000
Total Africa	36,116,000	39,364,000	38,132,000	37,889,000	42,552,000
AUSTRALASIA.					
Australia:					
Queensland	1,066,000	1,984,000	2,623,000	2,233,000	3,820,000
New South Wales	3,145,000	7,052,000	5,107,000	5,714,000	5,945,000
Victoria	774,000	933,000	643,000	661,000	727,000
Western Australia	2,000	3,000	1,000		1,000
Total Australia	4,987,000	9,972,000	8,374,000	8,608,000	10,493,000
New Zealand	627,000	547,000	506,000	653,000	419,000
Total Australasia	5,614,000	10,519,000	8,880,000	9,261,000	10,912,000
Grand total	3,066,506,000	3,109,934,000	3,447,617,000	3,877,913,000	3,300,255,000

Acreage, production, value, prices, and exports of corn in the United States, 1849–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including corn meal, fiscal year beginning July 1.	Per cent of crop exported.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*P. ct.*
1849*a*..	....	......	592,071,104	......	....	....	.....	.....	......	7,632,860	1.3
1859*a*..	....	......	838,792,742	......	....	....	.....	.....	......	4,248,991	.5
1866..	34,306,538	25.3	867,946,295	47.4	411,450,830	53	62	64	79	16,026,947	1.8
1867..	32,520,249	23.6	768,320,000	57.0	437,769,763	61	65	61	71	12,493,522	1.6
1868..	34,887,246	26.0	906,527,000	46.8	424,056,649	38	58	44	51	8,286,665	.9
1869..	37,103,245	23.6	874,320,000	59.8	522,550,509	56	67	73	85	2,140,487	.2
1870..	38,646,977	28.3	1,094,255,000	49.4	540,520,456	41	59	46	52	10,673,553	1.0
1871..	34,091,137	29.1	991,898,000	43.4	430,355,910	36	39	38	43	35,727,010	3.6
1872..	35,526,836	30.8	1,092,719,000	35.3	385,736,210	27	28	34	39	40,154,374	3.7
1873..	39,197,148	23.8	932,274,000	44.2	411,961,151	40	49	49	59	35,985,834	3.9
1874..	41,036,918	20.7	850,148,500	58.4	496,271,255	64	76	53	67	30,025,036	3.5
1875..	44,841,371	29.5	1,321,069,000	36.7	484,674,804	40	47	41	45	50,910,532	3.9
1876..	49,033,364	26.2	1,283,827,500	34.0	436,108,521	40	43	43	56	72,652,611	5.7
1877..	50,369,113	26.7	1,342,558,000	34.8	467,635,230	41	49	35	41	87,192,110	6.5
1878..	51,585,000	26.9	1,388,218,750	31.7	440,280,517	30	32	33	36	87,884,892	6.3
1879..	53,085,450	29.2	1,547,901,790	37.5	580,486,217	39	43¼	32⅜	36⅛	99,572,329	6.4
1880..	62,317,842	27.6	1,717,434,543	39.6	679,714,499	35⅝	42	41½	45	93,648,147	5.5
1881..	64,262,025	18.6	1,194,916,000	63.6	759,482,170	58½	63½	69	76⅞	44,340,683	3.7
1882..	65,659,545	24.6	1,617,025,100	48.5	783,867,175	49¼	61	53¼	56¾	41,655,653	2.6
1883..	68,301,889	22.7	1,551,066,895	42.4	658,051,485	54¼	63⅛	52½	57	46,258,606	3.0
1884..	69,683,780	25.8	1,795,528,432	35.7	640,735,859	34½	40¼	44¾	49	52,876,456	2.9
1885..	73,130,150	26.5	1,936,176,000	32.8	635,674,630	36	42¾	34¼	36¾	64,829,617	3.3
1886..	75,694,208	22.0	1,665,441,000	36.6	610,311,000	35¾	38	36⅞	39⅜	41,368,584	2.5
1887..	72,392,720	20.1	1,456,161,000	44.4	646,106,770	47	51⅛	54	60	25,360,869	1.7
1888..	75,672,763	26.3	1,987,790,000	34.1	677,561,580	33½	35⅞	33⅛	35⅜	70,841,673	3.6
1889..	78,319,651	27.0	2,112,892,000	28.3	597,918,829	29¼	35	32¾	35	103,418,709	4.9
1890..	71,970,763	20.7	1,489,970,000	50.6	754,433,451	47¾	53	55	69½	32,041,529	2.2
1891..	76,204,515	27.0	2,060,154,000	40.6	836,439,228	39⅜	59	40¾	*b*100	76,602,285	3.7
1892..	70,626,658	23.1	1,628,464,000	39.4	642,146,630	40	42⅞	39½	44½	47,121,894	2.9
1893..	72,036,465	22.5	1,619,496,131	36.5	591,625,627	34¼	36½	36¾	38½	66,489,529	4.1
1894..	62,582,269	19.4	1,212,770,052	45.7	554,719,162	44¾	47½	47¾	55½	28,585,405	2.4
1895..	82,075,830	26.2	2,151,138,580	25.3	544,985,534	25	26¾	27½	29½	101,100,375	4.7
1896..	81,027,156	28.2	2,283,875,165	21.5	491,006,967	22½	23¾	23	25½	178,817,417	7.8
1897..	80,095,051	23.8	1,902,967,933	26.3	501,072,952	25	27½	32⅜	37	212,055,543	11.1
1898..	77,721,781	24.8	1,924,184,660	28.7	552,023,428	33⅛	38	32½	34⅜	177,255,046	9.2
1899..	82,108,587	25.3	2,078,143,933	30.3	629,210,110	30	31½	36	40½	213,123,412	10.3
1900..	83,320,872	25.3	2,105,102,516	35.7	751,220,034	35¼	40½	42⅝	58½	181,405,473	8.6
1901..	91,349,928	16.7	1,522,519,891	60.5	921,555,768	62½	67½	59⅛	64¾	28,028,688	1.8
1902..	94,043,613	26.8	2,523,648,312	40.3	1,017,017,349	43¾	57¼	44	46	76,639,261	3.0
1903..	88,091,993	25.5	2,244,176,925	42.5	952,868,801	41	43¾	47¼	50	58,222,061	2.6
1904..	92,231,581	26.8	2,467,480,934	44.1	1,087,461,440	43½	49	48	64½	90,293,483	3.7
1905..	94,011,369	28.8	2,707,993,540	41.2	1,116,696,738	42	50¼	47½	50	119,893,833	4.4
1906..	96,737,581	30.3	2,927,416,091	39.9	1,166,626,479	40	46	49½	56	86,368,228	3.0
1907..	99,931,000	25.9	2,592,320,000	51.6	1,336,901,000	57½	61½	67¾	82	55,063,860	2.1
1908..	101,788,000	26.2	2,668,651,000	60.6	1,616,145,000	56¾	62¼	72¼	76	....	.....

a Census figures of production.   *b* Coincident with "corner."

Condition of the corn crop in the United States on the first of months named, 1888–1908.

Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1888....	93.0	95.5	94.2	92.0	1895....	99.3	102.5	96.4	95.5	1902....	87.5	86.5	84.3	79.6
1889....	90.3	94.8	90.9	91.7	1896....	92.4	96.0	91.0	90.5	1903....	79.4	78.7	80.1	80.8
1890....	93.1	73.3	70.1	70.6	1897....	82.9	84.2	79.3	77.1	1904....	86.4	87.3	84.6	83.9
1891....	92.8	90.8	91.1	92.5	1898....	90.5	87.0	84.1	82.0	1905....	87.3	89.0	89.5	89.2
1892....	81.1	82.5	79.6	79.8	1899....	86.5	89.9	85.2	82.7	1906....	87.5	88.1	90.2	90.1
1893....	93.2	87.0	76.7	75.1	1900....	89.5	87.5	80.6	78.2	1907....	80.2	82.8	80.2	78.0
1894....	95.0	69.1	63.4	64.2	1901....	81.3	54.0	51.7	52.1	1908....	82.8	82.5	79.4	77.8

Acreage, production, value, and distribution of corn in the United States in 1908, by States.

State, Territory, or Division.	Crop of 1908.			Stock in farmers' hands Mar. 1, 1909.		Shipped out of county where grown.	
	Acreage.	Production.	Farm value Dec. 1.				
	Acres.	*Bushels.*	*Dollars.*	*Bushels.*	*P. ct.*	*Bushels.*	*P. ct.*
Maine	14,000	567,000	476,000	113,000	20	0	0
New Hampshire	28,000	1,092,000	863,000	295,000	27	0	0
Vermont	62,000	2,499,000	1,949,000	800,000	32	0	0
Massachusetts	45,000	1,818,000	1,473,000	582,000	32	0	0
Rhode Island	10,000	428,000	385,000	163,000	38	4,000	1
Connecticut	58,000	2,395,000	1,916,000	695,000	29	24,000	1
New York	625,000	24,250,000	19,400,000	7,518,000	31	728,000	3
New Jersey	278,000	10,564,000	7,289,000	4,437,000	42	1,690,000	16
Pennsylvania	1,450,000	57,275,000	41,811,000	22,910,000	40	5,728,000	10
Delaware	195,000	6,240,000	3,682,000	2,808,000	45	2,496,000	40
Maryland	675,000	24,705,000	15,317,000	10,376,000	42	7,906,000	32
Virginia	1,925,000	50,050,000	35,536,000	22,022,000	44	6,006,000	12
West Virginia	768,000	23,962,000	18,451,000	8,626,000	36	1,438,000	6
North Carolina	2,787,000	50,166,000	39,631,000	23,578,000	47	2,007,000	4
South Carolina	2,073,000	29,229,000	26,598,000	14,907,000	51	877,000	3
Georgia	4,300,000	53,750,000	44,075,000	24,188,000	45	1,612,000	3
Florida	627,000	6,584,000	5,399,000	2,304,000	35	198,000	3
Ohio	3,550,000	136,675,000	86,105,000	51,936,000	38	32,802,000	24
Indiana	4,549,000	137,835,000	82,701,000	53,756,000	39	41,350,000	30
Illinois	9,450,000	298,620,000	170,213,000	140,351,000	47	131,393,000	44
Michigan	1,900,000	60,420,000	38,669,000	20,543,000	34	4,229,000	7
Wisconsin	1,474,000	49,674,000	30,301,000	16,392,000	33	993,000	2
Minnesota	1,615,000	46,835,000	25,759,000	15,456,000	33	4,684,000	10
Iowa	9,068,000	287,456,000	149,477,000	123,606,000	43	77,613,000	27
Missouri	7,542,000	203,634,000	116,071,000	77,382,000	38	20,363,000	10
North Dakota	162,000	3,856,000	2,314,000	733,000	19	39,000	1
South Dakota	1,942,000	57,677,000	28,838,000	18,457,000	32	19,033,000	33
Nebraska	7,621,000	205,767,000	104,941,000	82,307,000	40	74,076,000	36
Kansas	7,100,000	156,200,000	85,910,000	48,422,000	31	34,364,000	22
Kentucky	3,366,000	84,823,000	55,135,000	33,929,000	40	11,875,000	14
Tennessee	3,350,000	83,080,000	53,171,000	37,386,000	45	11,631,000	14
Alabama	3,050,000	44,835,000	37,213,000	19,279,000	43	1,345,000	3
Mississippi	2,650,000	45,845,000	38,051,000	18,338,000	40	917,000	2
Louisiana	1,712,000	33,898,000	23,729,000	11,864,000	35	1,017,000	3
Texas	7,854,000	201,848,000	119,090,000	70,647,000	35	24,222,000	12
Oklahoma	4,929,000	122,239,000	62,342,000	37,894,000	31	42,784,000	35
Arkansas	2,675,000	54,035,000	35,663,000	21,074,000	39	2,161,000	4
Montana	4,000	94,000	85,000	9,000	10	2,000	2
Wyoming	3,000	84,000	64,000	8,000	10	0	0
Colorado	128,000	2,586,000	1,836,000	698,000	27	129,000	5
New Mexico	65,000	1,755,000	1,404,000	439,000	25	88,000	5
Arizona	13,000	432,000	454,000	73,000	17	22,000	5
Utah	11,000	323,000	233,000	65,000	20	13,000	4
Idaho	6,000	174,000	122,000	30,000	17	7,000	4
Washington	13,000	332,000	252,000	56,000	17	10,000	3
Oregon	16,000	445,000	343,000	71,000	16	13,000	3
California	50,000	1,600,000	1,408,000	240,000	15	240,000	15
United States	101,788,000	2,668,651,000	1,616,145,000	1,047,763,000	39.3	568,129,000	21.3
Division: [a]							
North Atlantic	2,570,000	100,888,000	75,562,000	37,513,000	37.2	8,174,000	8.1
South Atlantic	13,350,000	244,686,000	188,689,000	108,809,000	44.5	22,540,000	9.2
North Central East of Miss. R.	20,923,000	683,224,000	407,989,000	282,978,000	41.4	210,767,000	30.8
North Central West of Miss. R.	35,050,000	961,425,000	513,310,000	366,363,000	38.1	230,172,000	23.9
South Central	29,586,000	670,603,000	424,394,000	250,411,000	37.3	95,952,000	14.3
Far Western	309,000	7,825,000	6,201,000	1,689,000	21.6	524,000	6.7

[a] North Atlantic Division includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania.

South Atlantic Division includes Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida.

North Central Division east of Mississippi River includes Ohio, Indiana, Illinois, Michigan, Wisconsin.

North Central Division west of Mississippi River includes Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.

South Central Division includes Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas.

Far Western Division includes Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, Washington, Oregon, California.

Average yield per acre of corn in the United States.

State, Territory, or Division.	10-year averages.				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	29.3	33.8	34.3	35.1	36.0	36.0	39.4	21.7	30.2	39.7	34.3	37.0	37.0	40.5
New Hampshire	35.5	35.5	34.5	34.0	39.0	37.0	38.5	23.3	21.0	27.3	37.0	37.5	35.0	39.0
Vermont	36.0	35.3	35.5	35.1	36.0	40.0	40.0	21.8	23.4	35.9	34.7	35.5	36.0	40.3
Massachusetts	34.6	32.5	35.7	35.9	36.0	38.0	40.5	31.3	24.0	36.0	37.5	39.7	36.0	40.4
Rhode Island	26.9	30.8	31.2	31.9	31.0	32.0	32.1	28.4	30.1	34.1	32.5	33.1	31.2	42.8
Connecticut	30.9	29.1	33.4	35.8	39.0	38.0	39.0	31.5	22.4	38.9	42.7	40.0	33.0	41.3
New York	31.6	30.4	31.1	30.3	31.0	32.0	33.0	25.0	25.0	27.3	31.5	34.9	27.0	38.8
New Jersey	36.5	32.8	30.9	34.3	39.0	33.0	36.9	34.5	24.0	38.0	35.8	36.3	31.5	38.0
Pennsylvania	35.1	32.6	30.4	34.5	32.0	25.0	35.0	36.1	31.2	34.0	38.9	40.2	32.5	39.5
Delaware	20.5	22.5	19.8	26.8	22.0	24.0	30.0	28.0	27.5	30.4	30.4	30.0	27.5	32.0
Maryland	24.7	26.0	23.5	32.0	32.0	26.0	34.2	32.4	28.7	33.4	36.9	35.0	34.2	36.6
Virginia	20.0	17.9	17.4	21.0	20.0	16.0	22.2	22.0	21.8	23.3	23.4	24.3	25.0	26.0
West Virginia	29.3	25.8	22.2	26.4	26.0	27.0	23.0	26.5	22.6	25.3	29.8	30.3	28.0	31.2
North Carolina	14.3	13.3	12.4	13.4	13.0	12.0	12.0	13.9	14.7	15.2	13.9	15.3	16.5	18.0
South Carolina	9.7	8.8	10.2	9.5	9.0	7.0	6.9	10.4	10.3	12.4	10.9	12.2	15.1	14.1
Georgia	11.3	10.3	11.2	10.5	10.0	10.0	10.0	9.0	11.7	11.9	11.0	12.0	13.0	12.5
Florida	10.9	9.5	10.2	9.3	10.0	8.0	9.0	8.6	9.9	10.7	10.1	11.0	11.3	10.5
Ohio	35.3	32.6	28.8	34.8	36.0	37.0	26.1	38.0	29.6	32.5	37.8	42.6	34.6	38.5
Indiana	32.3	29.9	28.9	34.0	38.0	38.0	19.8	37.9	33.2	31.5	40.7	39.6	36.0	30.3
Illinois	29.9	27.2	29.0	34.5	36.0	37.0	21.4	38.7	32.2	36.5	39.8	36.1	36.0	31.6
Michigan	32.2	31.8	26.7	32.2	25.0	36.0	34.5	26.4	33.5	28.6	34.0	37.0	30.1	31.8
Wisconsin	31.4	30.4	27.4	33.2	35.0	40.0	27.4	28.2	29.3	29.7	37.6	41.2	32.0	33.7
Minnesota	32.2	30.9	27.6	29.1	33.0	33.0	26.3	22.8	28.3	26.9	32.5	33.6	27.0	29.0
Iowa	34.3	31.8	30.1	32.4	31.0	38.0	25.0	32.0	28.0	32.6	34.8	39.5	29.5	31.7
Missouri	30.1	28.6	27.7	27.4	26.0	28.0	10.1	39.0	32.4	26.2	33.8	32.3	31.0	27.0
North Dakota	.....	.....	20.1	22.6	23.0	16.0	22.6	19.4	25.2	21.2	27.5	27.8	20.0	23.8
South Dakota	.....	.....	16.8	25.8	26.0	27.0	21.0	18.9	27.2	28.1	31.8	33.5	25.5	29.7
Nebraska	32.5	35.5	25.2	28.0	28.0	26.0	14.1	32.3	26.0	32.8	32.8	34.1	24.0	27.0
Kansas	33.5	33.4	22.2	22.0	27.0	19.0	7.8	29.9	25.6	20.9	27.7	28.9	22.1	22.0
Kentucky	29.3	26.0	24.9	25.5	21.0	26.0	15.6	27.0	26.6	26.9	29.7	33.0	28.2	25.2
Tennessee	22.9	21.4	21.5	21.9	20.0	20.0	14.2	21.9	23.5	25.0	24.6	28.1	26.0	24.8
Alabama	14.0	12.4	12.8	12.6	12.0	11.0	10.9	8.4	14.8	15.0	14.8	16.0	15.5	14.7
Mississippi	16.0	14.2	14.7	14.7	16.0	11.0	10.9	11.5	18.4	19.1	14.3	18.5	17.0	17.3
Louisiana	18.2	16.3	16.2	16.3	18.0	17.0	13.7	12.5	20.6	19.9	13.7	17.2	17.5	19.8
Texas	23.7	19.8	19.0	17.7	18.0	18.5	11.6	8.1	24.2	22.6	21.3	22.5	21.0	25.7
Oklahoma	.....	.....	.....	23.5	23.7	25.1	9.5	25.4	25.5	30.2	26.4	33.3	24.4	24.8
Arkansas	25.7	21.4	19.2	17.8	20.0	19.0	8.1	21.3	20.9	21.6	17.3	23.6	17.2	20.2
Montana	.....	26.6	26.1	22.3	23.0	15.0	25.0	22.0	24.1	22.2	19.4	23.4	22.5	23.4
Wyoming	.....	.....	23.6	24.7	22.0	34.0	39.5	19.8	19.4	32.5	26.9	27.0	25.0	28.0
Colorado	.....	25.3	22.8	18.7	17.0	19.0	17.1	16.5	19.8	20.5	23.8	27.9	23.5	20.2
New Mexico	.....	20.4	20.7	23.2	20.0	22.0	31.6	22.0	24.0	22.7	25.3	29.4	29.0	27.0
Arizona	.....	21.1	20.2	22.3	24.0	21.0	18.0	20.2	22.4	23.8	27.0	29.5	37.5	33.2
Utah	.....	23.3	19.9	23.8	20.0	20.0	19.4	20.1	21.4	33.2	36.2	32.0	25.5	29.4
Idaho	.....	22.5	24.2	27.7	18.0	38.0	23.0	24.7	34.5	29.3	27.2	28.3	30.0	29.0
Washington	.....	26.4	20.7	20.0	23.0	20.0	17.5	23.0	23.1	24.7	24.2	25.2	27.0	25.5
Oregon	29.5	26.3	24.3	23.8	22.0	23.0	20.8	23.4	25.8	28.8	23.0	27.6	27.5	27.8
California	28.6	29.2	29.6	29.9	27.0	25.0	31.0	30.5	30.7	28.6	32.0	34.9	34.0	32.0
United States	26.1	25.5	23.4	25.2	25.3	25.3	16.7	26.8	25.5	26.8	28.8	30.3	25.9	26.2
Division:[a]														
North Atlantic	34.2	32.0	30.9	33.5	33.0	28.6	35.0	32.5	28.3	32.9	36.7	38.3	31.3	39.3
South Atlantic	17.4	14.4	13.9	15.0	14.4	12.9	14.2	14.7	15.3	16.5	16.0	16.9	17.8	18.3
N. Central E. of Miss. R	31.9	29.2	28.7	34.2	35.7	37.4	23.1	36.8	31.9	33.7	39.2	38.4	35.0	32.7
N. Central W. of Miss. R	32.4	31.4	26.1	27.7	28.1	27.7	15.6	32.0	27.9	28.7	32.4	34.1	26.8	27.4
South Central	23.4	19.7	19.1	18.9	17.9	17.9	11.9	16.8	22.4	23.1	21.8	24.8	21.5	22.7
Far Western	28.7	25.6	24.3	23.1	19.8	20.8	23.1	21.6	23.8	24.1	26.3	29.6	27.5	25.3

[a] See note *a*, page 599.

Average farm value per acre of corn in the United States December 1.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	29.89	26.36	23.32	21.41	18.00	19.80	29.94	16.06	19.93	32.16	23.67	23.68	27.75	34.00
N. Hampshire	33.72	27.34	22.77	20.40	19.11	20.72	30.03	17.01	13.23	19.66	25.53	24.00	26.23	30.82
Vermont	33.84	26.12	22.72	20.01	16.92	20.00	29.20	14.82	14.51	26.21	23.60	20.95	27.00	31.44
Massachusetts	31.83	24.70	22.85	21.54	18.36	20.52	30.78	23.16	15.84	25.92	26.25	23.82	27.00	32.73
Rhode Island	26.63	24.33	21.22	21.69	16.43	21.44	24.40	22.15	24.38	28.64	23.08	21.18	25.00	38.50
Connecticut	29.66	21.53	21.38	21.84	19.50	20.90	29.25	23.31	15.01	28.40	30.32	24.00	24.75	33.03
New York	24.33	19.15	17.73	16.36	13.95	15.04	23.76	16.75	15.00	17.47	19.21	20.59	19.17	31.04
New Jersey	25.18	19.35	16.69	16.81	15.60	14.85	24.35	19.32	13.68	22.04	19.69	19.24	19.85	26.22
Pennsylvania	23.17	18.58	15.50	16.56	13.12	11.25	21.70	20.94	17.78	20.06	21.01	20.90	20.80	28.84
Delaware	11.89	11.02	8.71	10.99	7.48	9.12	17.10	13.72	13.48	14.90	14.29	12.60	14.30	18.88
Maryland	15.31	13.26	10.81	13.76	11.52	10.66	19.84	16.52	14.64	16.70	17.71	15.75	18.47	22.69
Virginia	11.40	9.13	8.18	9.87	7.60	7.84	13.10	11.44	11.55	13.75	12.40	13.37	16.00	18.46
W. Virginia	16.41	12.90	11.10	13.46	11.70	13.50	14.95	14.31	14.46	16.19	15.79	16.66	20.16	24.02
N. Carolina	9.30	7.58	6.57	7.37	6.11	6.84	8.76	8.34	8.97	9.42	8.90	10.40	12.21	14.22
S. Carolina	8.73	6.34	6.12	5.89	4.50	4.48	5.80	7.18	7.11	8.68	8.07	8.91	11.78	12.83
Georgia	9.15	7.00	6.61	6.40	5.00	5.70	8.20	6.57	8.07	8.45	7.70	8.04	9.88	10.25
Florida	12.23	7.60	6.83	6.04	5.30	4.80	7.65	6.62	7.23	8.02	6.67	6.82	9.04	8.61
Ohio	15.53	14.02	11.23	12.88	10.80	12.58	14.88	15.96	13.91	14.95	16.25	16.61	17.99	24.25
Indiana	12.27	11.36	10.40	11.22	10.26	12.16	10.89	13.64	11.95	12.91	15.47	14.26	16.20	18.18
Illinois	10.17	9.52	9.57	11.38	9.36	11.84	12.20	13.93	11.59	14.23	15.12	13.00	15.84	18.01
Michigan	17.39	14.63	11.75	13.20	9.00	13.32	17.94	13.73	15.41	14.87	15.64	16.28	16.56	20.35
Wisconsin	15.07	12.16	10.41	12.28	10.50	13.20	14.25	14.10	12.60	13.66	15.79	16.89	17.60	20.56
Minnesota	14.81	11.43	9.38	9.02	7.92	9.57	11.83	9.12	10.75	9.68	10.72	11.42	13.50	15.95
Iowa	10.29	8.59	9.03	9.40	7.13	10.26	13.00	10.56	10.64	10.76	11.83	12.64	12.69	16.48
Missouri	12.04	9.44	9.14	9.59	7.80	8.96	6.77	12.87	11.02	11.53	12.51	12.27	14.57	15.39
N. Dakota	......	......	7.44	8.59	7.59	6.72	10.40	8.73	10.58	8.48	9.90	10.84	12.00	14.28
S. Dakota	......	......	5.38	7.74	6.76	7.83	9.45	7.75	9.52	10.12	9.86	9.72	11.73	14.85
Nebraska	11.70	8.52	7.31	7.84	6.44	8.06	7.61	9.69	7.28	10.82	10.50	9.89	9.84	13.77
Kansas	14.07	9.35	7.10	7.26	6.75	6.08	4.91	10.17	9.22	8.57	9.14	9.25	9.72	12.10
Kentucky	12.01	10.92	9.96	10.71	7.77	10.40	9.52	11.34	14.90	13.18	12.77	13.86	14.95	16.38
Tennessee	10.76	8.99	8.82	9.64	7.80	9.80	9.23	10.29	11.52	12.50	12.30	13.21	14.82	15.87
Alabama	10.92	7.94	7.04	7.06	5.64	6.38	8.39	5.63	8.44	9.00	9.47	10.24	11.63	12.20
Mississippi	13.12	8.95	7.94	7.94	7.36	6.38	8.07	7.02	9.94	10.70	9.30	11.28	12.75	14.36
Louisiana	15.29	10.76	8.91	8.80	7.92	8.50	10.27	8.25	11.95	11.34	8.36	10.32	12.25	13.86
Texas	15.88	12.28	9.50	8.67	6.48	8.46	9.28	5.35	11.62	11.75	10.44	11.25	12.60	15.16
Oklahoma	......	......	......	9.16	3.80	6.76	7.38	10.38	9.84	11.96	10.10	10.32	10.72	12.65
Arkansas	16.96	11.34	9.02	8.54	7.60	8.17	6.56	10.44	10.66	11.45	9.51	11.09	11.70	13.33
Montana	......	23.41	18.27	14.72	11.96	8.85	22.50	15.84	14.94	15.10	13.19	15.21	15.25	21.25
Wyoming	......	......	14.63	15.07	9.46	20.40	28.44	11.68	11.25	18.52	20.17	15.93	17.33	21.33
Colorado	......	20.75	12.31	9.16	7.31	9.12	12.65	9.73	10.69	11.07	11.19	13.95	15.27	14.34
New Mexico	......	17.34	14.28	15.54	11.60	14.08	24.33	17.16	18.00	17.71	17.46	21.17	20.88	21.60
Arizona	......	17.72	15.15	20.96	......	......	16.20	20.40	20.16	21.66	26.19	25.08	33.75	34.92
Utah	......	17.94	12.14	15.71	11.80	12.60	17.46	13.47	14.98	23.90	25.34	23.68	18.36	21.18
Idaho	......	19.80	15.73	17.45	......	......	13.80	15.31	19.67	20.51	17.95	15.85	21.00	20.33
Washington	......	20.86	12.83	11.40	12.65	11.80	10.15	14.95	12.70	16.30	14.52	13.86	18.92	19.38
Oregon	25.96	21.30	15.07	14.28	14.08	13.11	11.86	15.44	17.29	17.57	13.57	17.94	20.38	21.44
California	38.60	23.07	17.76	19.73	16.20	15.25	21.08	23.49	22.72	22.31	52.32	23.38	28.91	28.16
United States	12.48	10.23	8.94	9.35	7.66	9.02	10.09	10.81	10.82	11.79	11.88	12.06	13.38	15.88
Division:[a]														
N. Atlantic	24.73	19.39	16.62	16.92	14.02	13.28	23.10	19.62	16.49	20.15	20.86	20.81	20.74	29.40
S. Atlantic	11.88	8.32	7.35	8.00	6.37	6.83	9.85	8.86	9.39	10.44	9.69	10.30	12.54	14.13
N. Central East of Miss. R.	12.41	11.07	10.22	11.76	9.89	12.25	12.86	14.19	12.41	14.04	15.45	14.38	16.46	19.50
N. Central West of Miss. R.	11.66	9.07	8.09	8.56	7.00	8.29	8.53	10.54	9.63	10.39	10.91	11.08	11.89	14.65
S. Central	13.43	9.95	8.84	8.83	7.01	8.31	8.63	8.38	11.20	11.61	10.51	11.47	12.61	14.34
Far Western	28.50	20.63	14.51	14.28	10.06	11.21	16.68	15.04	15.59	16.01	16.37	18.06	20.21	20.07

[a] See note *a*, page 599.

Average farm price of corn per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan. 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Maine	102	78	68	61	50	55	76	74	66	81	69	64	75	84	78	74	80	88	92	90
New Hampshire	95	77	66	60	49	56	78	73	63	72	69	64	75	79	77	73	77	85	89	83
Vermont	94	74	64	57	47	50	73	68	62	73	68	59	75	78	77	72	76	84	85	83
Massachusetts	92	76	64	60	51	54	76	74	66	72	70	60	75	81	77	76	80	84	91	86
Rhode Island	99	79	68	68	53	67	76	78	81	84	71	64	80	90	85	68	85	90	88	90
Connecticut	96	74	64	61	50	55	75	74	67	73	71	60	75	80	76	74	75	86	90	85
New York	77	63	57	54	45	47	72	67	60	64	61	59	71	80	74	69	71	76	83	81
New Jersey	69	59	54	49	40	45	66	56	57	58	55	53	63	69	67	70	75	80	88	76
Pennsylvania	66	57	51	48	41	45	62	58	57	59	54	52	64	73	68	67	73	80	82	72
Delaware	58	49	44	41	34	38	57	49	49	49	47	42	52	59	56	59	70	76	81	56
Maryland	62	51	46	43	36	41	58	51	51	50	48	45	54	62	58	59	68	76	84	62
Virginia	57	51	47	47	38	49	59	52	53	59	53	55	64	71	68	69	74	85	88	72
West Virginia	56	50	50	51	45	50	65	54	64	64	53	55	72	77	74	77	82	89	92	77
North Carolina	65	57	53	55	47	57	73	60	61	62	64	68	74	79	76	80	87	96	98	82
South Carolina	90	72	60	62	50	64	84	69	69	70	74	73	78	91	80	85	91	102	100	99
Georgia	81	68	59	61	50	57	82	73	69	71	70	67	76	82	77	82	90	99	98	89
Florida	103	80	67	65	53	60	85	77	73	75	66	62	80	82	80	82	87	94	92	87
Ohio	44	43	39	37	30	34	57	42	47	46	43	39	52	63	54	57	64	75	79	63
Indiana	38	38	36	33	27	32	55	36	36	41	38	36	45	60	46	49	60	69	76	60
Illinois	34	35	33	33	26	32	57	36	36	39	38	36	44	57	48	50	60	69	74	58
Michigan	54	46	44	41	36	37	52	52	46	52	46	44	55	64	58	61	66	74	77	69
Wisconsin	48	40	38	37	30	33	52	50	43	46	42	41	55	61	56	59	65	70	76	64
Minnesota	46	37	34	31	24	29	45	40	38	36	33	34	50	55	52	56	61	67	67	57
Iowa	30	27	30	29	23	27	52	33	38	33	34	32	43	52	47	50	58	65	70	53
Missouri	40	33	33	35	30	32	67	33	34	44	37	38	47	57	48	52	59	70	74	59
North Dakota	......	......	37	38	33	42	46	45	42	40	36	39	60	60	60	51	66	67	67	62
South Dakota	......	......	32	30	26	29	45	41	35	36	31	29	46	50	49	55	60	65	64	54
Nebraska	36	24	29	28	23	31	54	30	28	33	32	29	41	51	46	50	56	62	65	53
Kansas	42	28	32	33	25	32	63	34	36	41	33	32	44	55	46	52	59	66	70	57
Kentucky	41	42	40	42	37	40	61	42	56	49	43	42	53	65	56	63	68	82	86	65

Tennessee	47	42	41	44	39	49	65	47	49	50	50	47	57	64	57	64	72	82	82	63
Alabama	78	64	55	56	47	58	77	67	57	60	64	64	75	83	78	81	83	96	93	86
Mississippi	82	63	54	54	46	58	74	61	54	56	65	61	75	83	79	81	86	95	88	85
Louisiana	84	66	55	54	44	50	75	66	58	57	61	60	70	70	70	79	76	90	81	68
Texas	67	62	50	49	36	47	80	66	48	52	49	50	60	59	60	68	70	78	65	59
Oklahoma	......	......	......	39	21	29	76	41	38	40	34	31	44	51	45	53	56	70	64	50
Arkansas	66	53	47	48	38	43	81	49	51	53	55	47	68	66	70	72	75	88	82	65
Montana	......	88	70	66	52	59	90	72	62	68	68	65	68	90	69	78	71	80	85	80
Wyoming	......	......	62	61	43	60	72	59	58	57	75	59	70	76	73	70	85	85	75	75
Colorado	......	82	54	49	43	48	74	59	54	54	47	50	65	71	60	65	68	82	78	78
New Mexico	......	85	69	67	58	64	77	78	75	78	69	72	72	80	80	76	81	90	87	81
Arizona	......	84	75	94	70	73	90	101	90	91	97	85	90	105	97	97	100	112	109	98
Utah	......	77	61	66	59	63	90	67	70	72	70	74	72	72	70	71	73	84	67	72
Idaho	......	88	65	63	75	56	60	62	57	70	66	56	70	70	69	72	75	82	73	72
Washington	......	79	62	57	55	59	58	65	55	66	60	55	70	76	70	71	71	71	72	75
Oregon	88	81	62	60	64	57	57	66	67	61	59	65	74	77	75	70	75	80	75	73
California	100	79	60	66	60	61	68	77	74	78	76	67	85	88	84	85	85	87	85	91
United States	47.8	40.1	38.2	37.1	30.3	35.7	60.5	40.3	42.5	44.1	41.2	39.9	51.6	60.6	54.0	58.1	64.7	75.7	76.5	63.5
Division:[a]																				
North Atlantic	72.3	60.6	53.8	50.5	42.5	46.5	65.9	60.4	58.2	61.2	56.9	54.4	66.4	74.9	70.0	68.4	73.2	79.4	83.5	75.7
South Atlantic	68.3	57.8	52.9	53.3	44.3	53.0	69.6	60.1	61.4	63.3	60.6	61.1	70.6	77.1	73.0	76.4	83.1	94.6	95.3	84.1
North Central East of Mississippi River	38.9	37.9	35.6	34.4	27.7	32.7	55.7	38.5	38.9	41.7	39.4	37.5	47.1	59.7	49.8	52.4	61.4	70.5	75.7	60.7
North Central West of Mississippi River	36.0	28.9	31.0	30.9	24.9	29.9	54.7	33.0	34.5	36.2	33.7	32.5	44.3	53.4	47.3	51.4	58.3	65.8	69.4	55.4
South Central	57.4	50.5	46.3	46.7	39.2	46.5	72.5	49.9	50.0	50.2	48.2	46.3	58.8	63.3	60.1	66.8	70.1	82.6	76.6	64.9
Far Western	99.3	80.6	59.7	61.8	50.9	53.9	72.2	69.7	65.6	66.4	62.2	61.0	73.4	79.2	73.0	69.2	76.8	85.0	81.2	81.2

[a] See note a, page 599.

Wholesale prices of corn per bushel, 1895–1908.

Date.	New York.		Baltimore.		Cincinnati.		Chicago.		Detroit.		St. Louis.		San Francisco.	
	No. 2.		Mixed.[a]		No. 2.		No. 2.		No. 3.[b]		No. 2.		No. 1 white (per cwt.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.		
1895	32½	60¼	31	60¾	26	57	24⅞	54¼	26½	55	23½	54½	$0.82½	$1.27½
1896	25¼	41	22	36½	22	32½	19½	30⅝	20½	32	17¾	27¾	.75	.91¼
1897	27	38	22	39	22½	33½	21¾	32⅝	21½	32½	19¼	29½	.77½	1.12½
1898	33	44¼	29	43½	29	40	26	38	28½	39½	25¼	36¼	.85	1.17½
1899	36½	45⅝	34¾	43	31½	38	30	38⅛	32	38	29½	35¼	1.05	1.17½
1900	39⅞	52⅛	36⅜	48¾	32¾	47	30½	49½	32½	45	30½	43	1.00	1.30
1901	45½	72⅞	41½	68	38	71½	36	67½	37	70½	35	70	1.10	1.75
1902	57	73	43	77	44	69	43¾	88	57	70½	40½	69¼	1.30	1.65
1903	49¼	68½	46½	61	40	54½	41	53	40½	56½	39	55	1.17½	1.57½
1904	47⅛	69	49¼	58¾	45½	58½	42¾	59½	42	60	42½	57	1.25	1.55
1905.														
January	51¼	52½	44¼	50½	45½	46	42	43¼	45	46¾	43¾	45	1.25	1.55
February	51	54⅜	44	50¾	46	48½	42¾	45½	45½	48½	44	47	1.32½	1.45
March	52	54¾	45½	54	48	52	45½	48½	48½	51½	46	49	1.32½	1.40
April	51	52¾	48	52½	47½	50½	46	49½	49½	50	46¼	49½	1.32½	1.40
May	52	58¼	48¼	56½	49	54½	48	64½	49½	54	48	53	1.32½	1.50
June	57¾	62½	50¾	64	54	57	51¾	56¼	54	57¼	50½	56	1.40	1.45
July	59¾	63½	58	65	57	59½	53¾	59	57¼	58	51	58½	1.40	1.42½
August	60	62¾	56	63½	54	57½	53	57	55½	57	51½	54½	1.40	1.42½
September	59	61	56	63	54½	56½	51¼	54½	54½	55½	51½	54½	1.32½	1.40
October	58¼	62½	51	63	53½	56½	50	54½	55½	59	50	53½	1.30	1.32½
November	52½	62½	42	61	45½	53	45½	51½	44¼	55½	41½	51½	1.30	1.37½
December	50¾	53¼	42	51½	44½	47	42	50¼	44¾	45¾	41½	46½	1.32½	1.37½
1906.														
January	49½	51¼	47¾	49⅞	44	46	41	43	44½	45¾	41¾	43¾	......	......
February	47	49¾	45⅝	48⅜	42	44¾	41¼	45½	43	46¼	39¾	42⅝	......	......
March	47¼	52	46	49⅜	43	48	39	44	43¼	47	40¼	44½	......	......
April	52	56¼	49⅝	54¼	47	52½	43½	48	48½	52	43½	51½	......	......
May	55¾	58	55	57¼	51½	53½	47½	50	50¾	53½	49	51	......	......
June	58	61½	55	58	51½	54	50	54¾	52	55	48	53½	......	......
July	56¾	60	55¼	57¾	53½	55½	49½	53¼	53	55	50½	54½	......	......
August	55	58	54¼	55¾	50½	54¼	48½	51	52¼	54	46½	51	......	......
September	56¼	58½	53½	54¾	48	50½	47	50	49	52	46	47½	......	......
October	54¼	56	51⅛	54½	48	50	44¾	47¼	48¼	49¾	44	46	......	......
November	52¾	56	49	52	47½	48½	44	47¼	48¾	49¾	41	45½	......	......
December	50	53	50	51½	43	48	40	46	43½	49½	39½	45	......	......
1907.														
January	49½	52	47	50	43	47	39¾	43½	43	46	39	43	1.25	1.40
February	51¾	54½	49⅝	51⅛	46	48	43	44¼	45¾	46½	42½	45½	1.25	1.35
March	51¾	54	49⅛	51	46½	48¼	43	45	45	47	43	45½	1.27½	1.35
April	51¾	57¾	50½	56⅞	47½	53½	44¼	50¾	45½	50½	43	50½	1.27½	1.40
May	56½	63	55⅞	60¼	52½	57½	49½	56	50½	56¼	49	55½	1.35	1.55
June	60½	65	58⅛	60⅝	55	56½	51¾	54½	53½	56½	50¾	54	......	......
July	60	63	58	61½	55½	57	52	55¼	54¾	57	51¾	55	1.50	1.60
August	60¼	67⅝	59	63¾	56½	63	54	61½	57	62	53½	60	1.50	1.57½
September	67¼	77	64	70	63	66	60½	63¾	62	69½	59	63	1.52½	1.60
October	69	76⅛	64	74¼	58	71	55¾	66½	63	69½	53½	66	......	......
November	64½	71¼	61¼	67	59	62½	55½	60½	62	64	56	59½	......	......
December	67	76	59¾	68½	60	61½	57½	61½	58	64½	51½	59	......	......
1908.														
January	63½	69½	59⅞	65¾	55½	56	57	60	54½	59½	54¼	57½	......	......
February	60½	63¼	59⅜	61½	54½	60½	56½	59½	53½	61½	54¼	59	......	......
March	62½	70	62	66⅞	60½	66½	58½	66	61½	65½	58½	64½	1.60	1.70
April	69¼	75	66½	71	66½	69½	65	68	65	68½	63	67	1.65	1.70
May	72½	77½	71¼	74½	69½	76	67¾	82	69	75	67	73¾	1.65	1.80
June	74½	78	73½	76	70½	74½	67¼	74¼	71½	75	70½	75	1.80	1.87½
July	78¼	85	75½	80	71	81½	70½	78	72	79	74	81¼	1.80	1.90
August	......	......	80	83½	76½	82	77½	80	78½	80	76	79½	1.85	1.90
September	......	......	......	......	79½	83½	78	82	80	83	76½	81½	......	......
October	......	......	......	......	66½	79½	66	79	75	80	63½	77	1.85	1.90
November	71	74	67¾	71	63	66	62	66½	63	72	61	66½	......	......
December	65	71	63⅛	67½	58½	64	56¾	62¼	59	63	56¼	63	......	......

[a] No. 2 grade, 1895 to 1900.

[b] No. 2 grade, 1895 to 1904.

International trade in corn, including corn meal, 1903–1907.

General Note.—Substantially the international trade of the world. It should not be expected that the world export and import totals for any year will agree. Among sources of disagreement are these: (1) Different periods of time covered in the "year" of the various countries; (2) imports received in year subsequent to year of export; (3) want of uniformity in classification of goods among countries; (4) different practices and varying degrees of failure in recording countries of origin and ultimate destination; (5) different practices of recording reexported goods; (6) opposite methods of treating free ports; (7) clerical errors, which, it may be assumed, are not infrequent.

The exports given are domestic exports and the imports given are imports for consumption, as far as it is feasible and consistent so to express the facts. While there are some inevitable omissions from such a table as this, on the other hand, there are some duplications because of reshipments that do not appear as such in official reports. For the United Kingdom import figures refer to imports for consumption, when available, otherwise net imports.

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	82,845,915	97,221,783	87,487,629	106,047,790	50,262,705
Austria-Hungary	Jan. 1	310,804	174,342	63,218	22,361	a 120,144
Belgium	Jan. 1	6,579,655	6,287,688	8,078,215	6,588,557	7,644,848
Bulgaria	Jan. 1	5,089,114	9,762,657	3,870,090	5,658,543	10,225,222
Netherlands	Jan. 1	5,373,194	4,449,009	4,278,515	6,010,176	8,215,931
Roumania	Jan. 1	31,080,198	18,042,377	1,441,437	23,756,349	23,756,349
Russia	Jan. 1	25,349,683	18,633,663	7,372,386	9,879,982	a 38,623,929
Servia	Jan. 1	171,767	130,225	806,115	1,755,446	4,046,392
United States	Jan. 1	94,466,632	47,896,231	113,189,271	105,258,629	86,524,012
Uruguay	July 1	1,004,063	2,002,431	28,519	9,746	b 9,746
Other countries	....	601,500	346,346	4,199,950	2,713,077	a 5,631,077
Total	....	252,872,525	204,946,752	230,815,345	267,700,656	235,060,355

IMPORTS.

Austria-Hungary	Jan. 1	11,130,274	14,090,377	18,511,368	7,198,839	a 4,000,743
Belgium	Jan. 1	20,323,863	19,474,330	24,169,780	20,125,507	23,505,832
Canada	Jan. 1	13,075,283	8,896,007	11,898,604	12,714,257	16,187,579
Cape of Good Hope c	Jan. 1	3,471,281	1,236,927	2,171,601	315,835	51,298
Cuba	Jan. 1	619,326	696,517	1,843,348	2,489,087	3,053,939
Denmark	Jan. 1	8,772,022	9,284,777	10,859,257	18,855,752	158,148
Egypt	Jan. 1	142,537	53,017	1,279,749	1,438,435	196,539
France	Jan. 1	11,347,114	10,124,353	11,122,512	14,509,103	a 16,849,137
Germany d	Jan. 1	37,527,343	30,450,853	36,538,366	44,883,052	49,293,029
Italy	Jan. 1	15,092,527	8,365,123	5,902,875	8,666,763	a 2,815,120
Mexico	Jan. 1	530,081	121,138	1,115,007	1,882,218	1,554,145
Netherlands	Jan. 1	20,160,078	16,547,198	16,234,785	25,305,233	29,192,195
Norway	Jan. 1	765,246	555,991	544,596	718,276	1,937,926
Portugal	Jan. 1	366,605	531,889	2,724,050	370,611	b 370,611
Russia	Jan. 1	457,715	625,526	163,979	456,481	a 542,337
Spain	Jan. 1	1,484,490	2,761,426	1,904,186	2,647,975	a 4,552,177
Sweden	Jan. 1	189,357	234,986	491,035	564,946	330,588
Switzerland	Jan. 1	2,611,202	2,704,457	2,498,380	2,887,291	2,867,764
Transvaal e	Jan. 1	2,197,476	1,422,985	1,277,353	....	....
United Kingdom	Jan. 1	101,284,919	86,076,697	84,156,490	97,736,853	106,708,048
Other countries	....	7,325,628	3,306,140	7,432,369	4,812,269	a 4,111,205
Total	....	258,874,367	217,560,714	242,839,690	268,578,783	268,278,360

a Preliminary.
b Year preceding.
c British South Africa after 1905.
d Not including free ports prior to March 1, 1906.
e Included with British South Africa after 1905

WHEAT.

Wheat crop of countries named, 1904–1908.

Country.	1904.	1905.	1906.	1907.	1908.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	552,400,000	692,979,000	735,261,000	634,087,000	664,602,000
Canada:					
New Brunswick	371,000	418,000	420,000	525,000	360,000
Ontario	13,030,000	22,195,000	22,806,000	18,587,000	18,626,000
Manitoba	40,397,000	57,519,000	63,181,000	40,939,000	51,853,000
Saskatchewan	16,447,000	26,930,000	38,207,000	28,564,000	35,837,000
Alberta	968,000	2,379,000	4,091,000	4,092,000	5,058,000
Other	3,000,000	3,000,000	3,100,000	3,300,000	2,800,000
Total Canada	74,213,000	112,441,000	131,805,000	96,007,000	114,534,000
Mexico	9,393,000	9,710,000	8,000,000	9,000,000	8,000,000
Total North America	636,006,000	815,130,000	875,066,000	739,094,000	787,136,000
SOUTH AMERICA.					
Argentina	129,672,000	150,745,000	134,931,000	155,993,000	192,489,000
Chile	17,948,000	12,089,000	12,157,000	15,776,000	17,000,000
Uruguay	7,000,000	7,565,000	4,606,000	6,867,000	7,430,000
Total South America	154,620,000	170,399,000	151,694,000	178,636,000	216,919,000
EUROPE.					
Austria-Hungary:					
Austria	53,734,000	54,531,000	58,255,000	52,369,000	62,170,000
Hungary proper	137,078,000	157,514,000	197,408,000	120,506,000	152,204,000
Croatia-Slavonia	9,841,000	13,077,000	10,314,000	11,838,000	13,228,000
Bosnia-Herzegovina	3,753,000	3,016,000	2,693,000	2,168,000	3,022,000
Total Austria-Hungary	204,406,000	228,138,000	268,670,000	186,881,000	230,624,000
Belgium	13,817,000	12,401,000	12,964,000	15,835,000	13,000,000
Bulgaria	42,242,000	34,949,000	39,109,000	36,944,000	47,072,000
Denmark	4,282,000	4,067,000	4,161,000	4,343,000	4,400,000
Finland	133,000	129,000	100,000	100,000	135,000
France	298,826,000	335,453,000	324,919,000	376,999,000	310,526,000
Germany	139,803,000	135,947,000	144,754,000	127,843,000	138,442,000
Greece	8,000,000	8,000,000	8,000,000	8,000,000	7,000,000
Italy	167,635,000	160,504,000	176,462,000	177,544,000	150,792,000
Montenegro	200,000	200,000	200,000	200,000	200,000
Netherlands	4,423,000	5,109,000	4,978,000	5,325,000	5,075,000
Norway	212,000	329,000	303,000	290,000	330,000
Portugal	9,000,000	5,000,000	9,000,000	6,000,000	5,000,000
Roumania	53,738,000	103,328,000	113,867,000	42,237,000	54,813,000
Russia:					
Russia proper	519,964,000	451,327,000	344,765,000	340,416,000	....
Poland	21,241,000	20,239,000	21,152,000	18,173,000	....
Northern Caucasia	81,050,000	96,708,000	85,046,000	79,184,000	....
Total Russia (European)	622,255,000	568,274,000	450,963,000	437,773,000	[a] 569,484,000
Servia	11,676,000	11,280,000	13,211,000	8,375,000	14,000,000
Spain	95,377,000	92,504,000	140,656,000	100,331,000	119,970,000
Sweden	5,135,000	5,529,000	6,350,000	5,953,000	6,756,000
Switzerland	4,000,000	4,000,000	4,000,000	4,000,000	3,527,000
Turkey (European)	23,000,000	20,000,000	25,000,000	18,000,000	25,000,000
United Kingdom:					
Great Britain—					
England	35,624,000	57,424,000	57,583,000	53,855,000	51,371,000
Scotland	1,499,000	2,130,000	2,063,000	1,953,000	1,854,000
Wales	919,000	1,204,000	1,308,000	1,138,000	966,000
Ireland	1,040,000	1,430,000	1,527,000	1,367,000	1,394,000
Total United Kingdom	39,082,000	62,188,000	62,481,000	58,313,000	55,585,000
Total Europe	1,747,242,000	1,797,329,000	1,810,448,000	1,621,286,000	[a] 1,761,731,000

[a] Including Asiatic Russia.

Wheat crop of countries named, 1904–1908—Continued.

Country.	1904.	1905.	1906.	1907.	1908.
ASIA.					
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
British India, including such native States as report.....	359,936,000	283,063,000	319,952,000	317,023,000	229,092,000
Cyprus....................	2,176,000	2,441,000	2,410,000	2,636,000	2,700,000
Japanese Empire:					
Japan..................	19,754,000	18,437,000	20,283,000	22,932,000	22,266,000
Formosa................	190,000	200,000	178,000	200,000	200,000
Total Japanese Empire	19,944,000	18,637,000	20,461,000	23,132,000	22,466,000
Persia....................	16,000,000	16,000,000	16,000,000	16,000,000	16,000,000
Russia:					
Central Asia.............	12,822,000	25,491,000	11,486,000	27,085,000	....
Siberia..................	31,590,000	42,411,000	45,833,000	45,771,000	....
Transcaucasia[a].........	82,000	109,000	108,000	63,000	....
Total Russia (Asiatic).	44,494,000	68,011,000	57,427,000	72,919,000	(b)
Turkey (Asiatic)............	35,000,000	35,000,000	35,000,000	35,000,000	35,000,000
Total Asia.............	477,550,000	423,152,000	451,250,000	466,710,000	[b] 305,258,000
AFRICA.					
Algeria......................	25,484,000	25,579,000	34,323,000	31,261,000	28,000,000
Cape of Good Hope..........	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Egypt.......................	25,000,000	25,000,000	25,000,000	25,000,000	25,000,000
Natal........................	7,000	4,000	8,000	3,000	3,000
Sudan (Anglo-Egyptian)....	486,000	483,000	542,000	500,000	500,000
Tunis.......................	10,519,000	5,729,000	4,906,000	6,314,000	2,838,000
Total Africa...........	63,496,000	58,795,000	66,779,000	65,078,000	58,341,000
AUSTRALASIA.					
Australia:					
Queensland.............	2,514,000	2,217,000	1,173,000	1,144,000	715,000
New South Wales.......	28,196,000	16,983,000	21,391,000	22,506,000	9,360,000
Victoria.................	29,425,000	21,666,000	24,156,000	23,331,000	12,482,000
South Australia.........	13,626,000	12,454,000	20,779,000	18,017,000	19,739,000
Western Australia.......	1,935,000	2,077,000	2,381,000	2,845,000	3,026,000
Tasmania...............	792,000	818,000	801,000	672,000	665,000
Total Australia........	76,488,000	56,215,000	70,681,000	68,515,000	45,987,000
New Zealand................	8,140,000	9,411,000	7,013,000	5,782,000	5,743,000
Total Australasia......	84,628,000	65,626,000	77,694,000	74,297,000	51,730,000
Grand total...........	3,163,542,000	3,330,431,000	3,432,931,000	3,145,101,000	3,181,115,000

[a] Includes Chernomorsk only. [b] See note *a*, p. 606.

Acreage, production, value, prices, and exports of wheat in the United States, 1849–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel December 1.	Farm value December 1.	Chicago cash price per bushel, No. 1 northern. December. Low.	December. High.	May of following year. Low.	May of following year. High	Domestic exports, including flour, fiscal year beginning July 1.	Per cent of crop exported.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*P. ct.*
1849 [a]	....	......	100,485,944	......	....	......	......	......	......	7,535,901	7.5
1859 [a]	....	......	173,104,924	......	....	......	......	......	......	17,213,133	9.9
1866...	15,424,496	9.9	151,999,906	152.7	232,109,630	129	145	185	211	12,646,941	8.3
1867...	18,321,561	11.6	212,441,400	145.2	308,387,146	126	140	134	161	26,323,014	12.4
1868...	18,460,132	12.1	224,036,600	108.5	243,032,746	80	88	87	96	29,717,201	13.3
1869...	19,181,004	13.6	260,146,900	76.5	199,024,996	63	76	79	92	53,900,780	20.7
1870...	18,992,591	12.4	235,884,700	94.4	222,766,969	91	98	113	120	52,574,111	22.3
1871...	19,943,893	11.6	230,722,400	114.5	264,075,851	107	111	120	143	38,995,755	16.9
1872...	20,858,359	11.9	249,997,100	111.4	278,522,068	97	108	112	122	52,014,715	20.8
1873...	22,171,676	12.7	281,254,700	106.9	300,669,528	96	106	105	114	91,510,398	32.5
1874...	24,967,027	12.3	308,102,700	86.3	265,881,167	78	83	78	94	72,912,817	23.7
1875...	26,381,512	11.1	292,136,000	89.5	261,396,926	82	91	89	100	74,750,682	25.6
1876...	27,627,021	10.5	289,356,500	96.3	278,697,238	104	117	130	172	57,043,936	19.7
1877...	26,277,546	13.9	364,194,146	105.7	385,089,444	103	108	98	113	92,141,626	25.3
1878...	32,108,560	13.1	420,122,400	77.6	325,814,119	81	84	91	102	150,502,506	35.8
1879...	32,545,950	13.8	448,756,630	110.8	497,030,142	122	133½	112½	119	180,304,180	40.2
1880...	37,986,717	13.1	498,549,868	95.1	474,201,850	93½	109¾	101	112⅝	186,321,514	37.4
1881...	37,709,020	10.2	383,280,090	119.2	456,880,427	124¾	129	123	140	121,892,389	31.8
1882...	37,067,194	13.6	504,185,470	88.4	445,602,125	91⅛	94¾	108	113⅜	147,811,316	29.3
1883...	36,455,593	11.6	421,086,160	91.1	383,649,272	94⅝	99¼	85	94¼	111,534,182	26.5
1884...	39,475,885	13.0	512,765,000	64.5	330,862,260	69½	76⅜	85⅜	90¾	132,570,366	25.9
1885...	34,189,246	10.4	357,112,000	77.1	275,320,390	82⅞	89	72⅛	79	94,565,793	26.5
1886...	36,806,184	12.4	457,218,000	68.7	314,226,020	75⅛	79½	80¾	88¾	153,804,969	33.6
1887...	37,641,783	12.1	456,329,000	68.1	310,612,960	75⅛	79¼	81¼	89⅞	119,625,344	26.2
1888...	37,336,138	11.1	415,868,000	92.6	385,248,030	96⅝	105½	77¼	95½	88,600,743	21.3
1889...	38,123,859	12.9	490,560,000	69.8	342,491,707	76¾	80½	89¾	100	109,430,467	22.3
1890...	36,087,154	11.1	399,262,000	83.8	334,773,678	87½	92¾	98⅞	108¼	106,181,316	26.6
1891...	39,916,897	15.3	611,780,000	83.9	513,472,711	89⅜	93¼	80	85¾	225,665,811	36.9
1892...	38,554,430	13.4	515,949,000	62.4	322,111,881	69½	73	68¼	70¼	191,912,635	37.2
1893...	34,629,418	11.4	396,131,725	53.8	213,171,381	59⅛	64½	52⅛	60½	164,283,129	41.5
1894...	34,882,436	13.2	460,267,416	49.1	225,902,025	52¾	63⅝	60¼	85⅜	144,812,718	31.5
1895...	34,047,332	13.7	467,102,947	50.9	237,938,998	53¾	64¾	57⅛	67⅝	126,443,968	27.1
1896...	34,618,646	12.4	427,684,346	72.6	310,602,539	74⅝	93⅛	68¾	97⅞	145,124,972	33.9
1897...	39,465,066	13.4	530,149,168	80.8	428,547,121	92	109	117	185	217,306,005	41.0
1898...	44,055,278	15.3	675,148,705	58.2	392,770,320	62¼	70	68⅜	79½	222,618,420	33.0
1899...	44,592,516	12.3	547,303,846	58.4	319,545,259	64	69½	63⅝	67½	186,096,762	34.0
1900...	42,495,385	12.3	522,229,505	61.9	323,515,177	69¼	74⅝	70	75⅛	215,990,073	41.4
1901...	49,895,514	15.0	748,460,218	62.4	467,350,156	73	79½	72⅜	76¼	234,772,516	31.4
1902...	46,202,424	14.5	670,063,008	63.0	422,224,117	71⅞	77¾	74¾	80⅝	202,905,598	30.3
1903...	49,464,967	12.9	637,821,835	69.5	443,024,826	77¾	87	87¾	101½	120,727,613	18.9
1904...	44,074,875	12.5	552,399,517	92.4	510,489,874	115	122	89½	113¾	44,112,910	8.0
1905...	47,854,079	14.5	692,979,489	74.8	518,372,727	82½	90	80¼	87¼	97,609,007	14.1
1906...	47,305,829	15.5	735,260,970	66.7	490,332,760	[b] 72⅝	[b] 75	84	106	146,700,425	20.0
1907...	45,211,000	14.0	634,087,000	87.4	554,437,000	[b] 104¼	[b] 109	[b] 103	[b] 111½	163,043,669	25.7
1908...	47,557,000	14.0	664,602,000	92.8	616,826,000	106½	112	126½	137	....	......

[a] Census figures of production. [b] No. 2 red winter.

Acreage, production, value, and distribution of wheat in the United States in 1908.

State, Territory, or Division.	Crop of 1908. Acreage.	Crop of 1908. Production.	Crop of 1908. Farm value Dec. 1.	Stock in farmers' hands Mar. 1, 1909.		Shipped out of county where grown.	
	Acres.	*Bushels.*	*Dollars.*	*Bushels.*	*P. ct.*	*Bushels.*	*P. ct.*
Maine	8,000	188,000	196,000	71,000	38	0	0
Vermont	1,000	23,000	23,000	9,000	38	0	0
New York	443,000	7,752,000	7,674,000	1,938,000	25	1,628,000	21
New Jersey	108,000	1,868,000	1,887,000	430,000	23	504,000	27
Pennsylvania	1,590,000	29,415,000	29,121,000	10,001,000	34	10,001,000	34
Delaware	115,000	1,725,000	1,725,000	414,000	24	1,035,000	60
Maryland	765,000	12,546,000	12,295,000	2,509,000	20	8,155,000	65
Virginia	780,000	8,892,000	8,981,000	2,490,000	28	3,201,000	36
West Virginia	361,000	4,693,000	4,834,000	1,408,000	30	845,000	18
North Carolina	568,000	5,680,000	6,078,000	1,988,000	35	341,000	6
South Carolina	315,000	2,835,000	3,686,000	680,000	24	57,000	2
Georgia	240,000	2,208,000	2,672,000	442,000	20	88,000	4
Ohio	2,083,000	33,328,000	32,995,000	8,999,000	27	15,997,000	48
Indiana	2,721,000	45,169,000	44,266,000	10,389,000	23	24,391,000	54
Illinois	2,324,000	30,212,000	29,306,000	5,740,000	19	16,919,000	56
Michigan	874,000	15,732,000	15,260,000	3,933,000	25	7,237,000	46
Wisconsin	183,000	3,328,000	3,062,000	1,132,000	34	566,000	17
Minnesota	5,356,000	68,557,000	64,444,000	16,454,000	24	45,933,000	67
Iowa	468,000	8,068,000	7,100,000	2,743,000	34	3,792,000	47
Missouri	2,226,000	22,260,000	20,702,000	4,452,000	20	9,794,000	44
North Dakota	5,899,000	68,428,000	62,954,000	13,686,000	20	54,058,000	79
South Dakota	2,958,000	37,862,000	34,833,000	8,330,000	22	30,290,000	80
Nebraska	2,571,000	44,295,000	37,208,000	11,074,000	25	30,121,000	68
Kansas	6,308,000	79,282,000	69,768,000	11,892,000	15	57,083,000	72
Kentucky	758,000	8,793,000	8,617,000	1,759,000	20	3,078,000	35
Tennessee	819,000	8,190,000	8,108,000	1,720,000	21	2,457,000	30
Alabama	95,000	1,092,000	1,168,000	273,000	25	33,000	3
Mississippi	1,000	14,000	14,000	....	.....	0	0
Texas	924,000	10,164,000	9,961,000	1,220,000	12	2,541,000	25
Oklahoma	1,347,000	15,625,000	13,750,000	2,188,000	14	10,156,000	65
Arkansas	162,000	1,620,000	1,539,000	405,000	25	113,000	7
Montana	153,000	3,703,000	3,185,000	592,000	16	1,852,000	50
Wyoming	70,000	1,775,000	1,509,000	532,000	30	89,000	5
Colorado	293,000	6,153,000	5,415,000	1,292,000	21	2,154,000	35
New Mexico	41,000	1,025,000	964,000	205,000	20	72,000	7
Arizona	15,000	400,000	480,000	64,000	16	20,000	5
Utah	220,000	5,825,000	4,952,000	1,806,000	31	2,796,000	48
Nevada	33,000	990,000	1,119,000	198,000	20	495,000	50
Idaho	387,000	10,897,000	8,063,000	2,179,000	20	7,410,000	68
Washington	1,446,000	27,162,000	22,273,000	4,346,000	16	20,915,000	77
Oregon	728,000	15,148,000	12,725,000	2,424,000	16	9,392,000	62
California	800,000	11,680,000	11,914,000	1,285,000	11	7,826,000	67
United States	47,557,000	664,602,000	616,826,000	143,692,000	21.6	393,435,000	59.2
Division: [a]							
North Atlantic	2,150,000	39,246,000	38,901,000	12,449,000	31.7	12,133,000	30.9
South Atlantic	3,144,000	38,579,000	40,271,000	9,931,000	25.7	13,722,000	35.6
North Central E. of Miss. R	8,185,000	127,769,000	124,889,000	30,193,000	23.6	65,110,000	51.0
North Central W. of Miss. R	25,786,000	328,752,000	297,009,000	68,631,000	20.9	231,071,000	70.3
South Central	4,106,000	45,498,000	43,157,000	7,565,000	16.6	18,378,000	40.4
Far Western	4,186,000	84,758,000	72,599,000	14,923,000	17.6	53,021,000	62.6

[a] See note *a*, page 599.

Acreage, production, and farm value December 1 of winter and spring wheat in the United States in 1908.

State, Territory, or Division.	Winter wheat.					Spring wheat.				
	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bu.*	*Bushels.*	*Cts.*	*Dollars.*	*Acres.*	*Bu.*	*Bushels.*	*Cts.*	*Dollars.*
Maine	....	....	....	....	....	8,000	23.5	188,000	104	196,000
Vermont	....	....	....	....	....	1,000	23.0	23,000	99	23,000
New York	443,000	17.5	7,752,000	99	7,674,000	....	....	....	....	....
New Jersey	108,000	17.3	1,868,000	101	1,887,000	....	....	....	....	....
Pennsylvania	1,590,000	18.5	29,415,000	99	29,121,000	....	....	....	....	....
Delaware	115,000	15.0	1,725,000	100	1,725,000	....	....	....	....	....
Maryland	765,000	16.4	12,546,000	98	12,295,000	....	....	....	....	....
Virginia	780,000	11.4	8,892,000	101	8,981,000	....	....	....	....	....
West Virginia	361,000	13.0	4,693,000	103	4,834,000	....	....	....	....	....
North Carolina	568,000	10.0	5,680,000	107	6,078,000	....	....	....	....	....
South Carolina	315,000	9.0	2,835,000	130	3,686,000	....	....	....	....	....
Georgia	240,000	9.2	2,208,000	121	2,672,000	....	....	....	....	....
Ohio	2,083,000	16.0	33,328,000	99	32,995,000	....	....	....	....	....
Indiana	2,721,000	16.6	45,169,000	98	44,266,000	....	....	....	....	....
Illinois	2,324,000	13.0	30,212,000	97	29,306,000	....	....	....	....	....
Michigan	874,000	18.0	15,732,000	97	15,260,000	....	....	....	....	....
Wisconsin	63,000	19.5	1,228,000	92	1,130,000	120,000	17.5	2,100,000	92	1,932,000
Minnesota	....	....	....	....	....	5,356,000	12.8	68,557,000	94	64,444,000
Iowa	148,000	21.0	3,108,000	88	2,735,000	320,000	15.5	4,960,000	88	4,365,000
Missouri	2,226,000	10.0	22,260,000	93	20,702,000	....	....	....	....	....
North Dakota	....	....	....	....	....	5,899,000	11.6	68,428,000	92	62,954,000
South Dakota	....	....	....	....	....	2,958,000	12.8	37,862,000	92	34,833,000
Nebraska	2,265,000	17.8	40,317,000	84	33,866,000	306,000	13.0	3,978,000	84	3,342,000
Kansas	6,108,000	12.8	78,182,000	88	68,800,000	200,000	5.5	1,100,000	88	968,000
Kentucky	758,000	11.6	8,793,000	98	8,617,000	....	....	....	....	....
Tennessee	819,000	10.0	8,190,000	99	8,108,000	....	....	....	....	....
Alabama	95,000	11.5	1,092,000	107	1,168,000	....	....	....	....	....
Mississippi	1,000	14.5	14,000	103	14,000	....	....	....	....	....
Texas	924,000	11.0	10,164,000	98	9,961,000	....	....	....	....	....
Oklahoma	1,347,000	11.6	15,625,000	88	13,750,000	....	....	....	....	....
Arkansas	162,000	10.0	1,620,000	95	1,539,000	....	....	....	....	....
Montana	....	....	....	....	....	153,000	24.2	3,703,000	86	3,185,000
Wyoming	20,000	25.0	500,000	85	425,000	50,000	25.5	1,275,000	85	1,084,000
Colorado	....	....	....	....	....	293,000	21.0	6,153,000	88	5,415,000
New Mexico	....	....	....	....	....	41,000	25.0	1,025,000	94	964,000
Arizona	....	....	....	....	....	15,000	26.7	400,000	120	480,000
Utah	50,000	23.0	1,150,000	85	978,000	170,000	27.5	4,675,000	85	3,974,000
Nevada	....	....	....	....	....	33,000	30.0	990,000	113	1,119,000
Idaho	232,000	30.0	6,960,000	74	5,150,000	155,000	25.4	3,937,000	74	2,913,000
Washington	576,000	24.5	14,112,000	82	11,572,000	870,000	15.0	13,050,000	82	10,701,000
Oregon	468,000	23.2	10,858,000	84	9,121,000	260,000	16.5	4,290,000	84	3,604,000
California	800,000	14.6	11,680,000	102	11,914,000	....	....	....	....	....
United States	30,349,000	14.4	437,908,000	93.7	410,330,000	17,208,000	13.2	226,694,000	91.1	206,496,000
Division: [a]										
N. Atlantic	2,141,000	18.2	39,035,000	99.1	38,682,000	9,000	23.4	211,000	103.8	219,000
S. Atlantic	3,144,000	12.3	38,579,000	104.4	40,271,000	....	....	....	....	....
N. Central E. Miss. R.	8,065,000	15.6	125,669,000	97.8	122,957,000	120,000	17.5	2,100,000	92.0	1,932,000
N. Central W. Miss. R.	10,747,000	13.4	143,867,000	87.7	126,103,000	15,039,000	12.3	184,885,000	92.4	170,906,000
South Central	4,106,000	11.1	45,498,000	94.9	43,157,000	....	....	....	....	....
Far Western	2,146,000	21.1	45,260,000	86.5	39,160,000	2,040,000	19.4	39,498,000	84.7	33,439,000

[a] See note *a*, page 599.

Condition of the wheat crop in the United States on the first of months named, 1888–1909.

Year.	Winter wheat.						Spring wheat.			
	December of previous year.	April.	May.	June.	July.	When harvested.	June.	July.	August.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1888	95.9	82.0	73.1	73.3	75.6	77.4	92.8	95.9	87.3	77.2
1889	96.8	94.0	96.0	93.1	92.0	89.4	94.4	83.3	81.2	83.8
1890	95.3	81.0	80.0	78.1	76.2	73.5	91.3	94.4	83.2	79.8
1891	98.4	96.9	97.9	96.6	96.2	96.7	92.6	94.1	95.5	97.2
1892	85.3	81.2	84.0	88.3	89.6	87.6	92.3	90.9	87.3	81.2
1893	87.4	77.4	75.3	75.5	77.7	[a] 74.0	86.4	74.1	67.0	....
1894	91.5	86.7	81.4	83.2	83.9	[a] 83.7	88.0	68.4	67.1	....
1895	89.0	81.4	82.9	71.1	65.8	[a] 75.4	97.8	102.2	95.9	....
1896	81.4	77.1	82.7	77.9	75.6	[a] 74.6	99.9	93.3	78.9	....
1897	99.5	81.4	80.2	78.5	81.2	[a] 85.7	89.6	91.2	86.7	....
1898	....	86.7	86.5	90.8	85.7	[a] 86.7	100.9	95.0	96.5	....
1899	92.6	77.9	76.2	67.3	65.6	[a] 70.9	91.4	91.7	83.6	....
1900	97.1	82.1	88.9	82.7	80.8	[a] 69.6	87.3	55.2	56.4	....
1901	97.1	91.7	94.1	87.8	88.3	[a] 82.8	92.0	95.6	80.3	....
1902	86.7	78.7	76.4	76.1	77.0	[a] 80.0	95.4	92.4	89.7	....
1903	99.7	97.3	92.6	82.2	78.8	[a] 74.7	95.9	82.5	77.1	....
1904	86.6	76.5	76.5	77.7	78.7	....	93.4	93.7	87.5	66.2
1905	82.9	91.6	92.5	85.5	82.7	....	93.7	91.0	89.2	87.3
1906	94.1	89.1	90.9	82.7	85.6	....	93.4	91.4	86.9	83.4
1907	94.1	89.9	82.9	77.4	78.3	....	88.7	87.2	79.4	77.1
1908	91.1	91.3	89.0	86.0	80.6	....	95.0	89.4	80.7	77.6
1909	85.3	82.2	83.5	80.7	82.4	....	95.2	92.7	....	....

[a] Includes both winter and spring.

Average yield of wheat in countries named, bushels per acre, 1888–1907.

Year.	United States.[a]	Russia, European.[b]	Germany.[b]	Austria.[b]	Hungary proper.[b]	France.[a]	United Kingdom.[a]
Average (1888 to 1897)	12.8	8.4	22.7	15.6	17.9	17.6	30.1
1898	15.3	9.6	27.2	18.0	17.1	21.1	35.8
1899	12.3	8.7	28.4	19.0	17.8	21.2	35.8
1900	12.3	8.3	27.9	15.5	16.9	19.2	29.5
1901	15.0	8.1	23.5	16.7	15.1	18.5	31.9
1902	14.5	11.1	30.3	19.0	20.7	20.2	33.9
1903	12.9	10.6	29.2	17.8	19.0	22.8	31.1
1904	12.5	11.5	29.5	19.5	16.3	19.3	27.8
1905	14.5	10.0	28.5	19.6	18.7	20.8	33.9
1906	15.5	7.7	30.3	20.2	22.5	20.2	34.7
1907	14.0	7.9	29.6	18.0	15.1	23.2	35.0
Average (1898 to 1907)	13.9	9.3	28.4	18.3	17.9	20.8	32.6

[a] Winchester bushels. [b] Bushels of 60 pounds.

Average yield per acre of wheat in the United States.

State, Territory, or Division.	10-year averages.				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	13.2	13.7	15.8	22.1	22.5	19.5	23.9	25.3	25.5	23.3	23.0	24.8	26.2	23.5
New Hampshire	15.2	14.6	15.8	17.9	17.2	16.3	.....	.....	.....	.....	.....	.....	.....	.....
Vermont	17.0	16.8	18.8	21.2	22.0	23.5	18.7	18.8	20.9	25.1	18.8	22.3	23.0	23.0
Connecticut	17.2	16.5	16.1	19.8	18.3	20.8	.....	.....	.....	.....	.....	.....	.....	.....
New York	14.1	15.5	15.4	17.5	18.5	17.7	13.1	16.8	17.8	11.3	21.0	20.0	17.3	17.5
New Jersey	14.6	13.3	13.4	16.1	14.5	19.1	16.8	16.0	14.0	13.3	16.4	18.3	18.5	17.3
Pennsylvania	13.3	13.4	13.6	15.8	13.6	13.5	17.1	15.8	15.6	14.1	17.1	17.7	18.6	18.5
Delaware	10.9	12.5	12.1	16.0	12.8	20.3	18.5	16.5	10.2	14.9	13.8	16.0	20.5	15.0
Maryland	10.6	12.8	13.3	15.9	14.1	19.5	17.2	14.7	12.5	13.4	16.3	16.0	19.0	16.4
Virginia	8.3	8.3	8.8	10.3	8.4	11.9	10.9	5.7	8.7	10.2	11.4	12.5	12.5	11.4
West Virginia	10.3	10.8	10.3	10.8	9.3	9.8	10.9	7.7	10.2	10.1	12.3	12.7	12.2	13.0
North Carolina	7.2	6.6	6.2	7.5	6.7	9.6	8.7	5.3	5.1	8.6	6.7	9.1	9.5	10.0
South Carolina	6.0	6.6	5.7	7.7	6.5	9.0	8.8	5.6	6.5	8.1	6.1	9.3	8.5	9.0
Georgia	6.9	6.9	6.1	7.9	6.8	9.1	8.2	6.0	6.2	8.8	6.9	10.0	9.0	9.2
Ohio	12.0	14.6	14.4	13.8	14.2	6.0	15.3	17.1	13.7	11.5	17.1	20.4	16.3	16.0
Indiana	11.0	13.9	13.9	12.2	9.8	5.3	15.8	16.0	10.0	9.2	18.3	20.7	14.4	16.6
Illinois	11.9	13.1	14.3	13.0	10.0	13.0	17.6	17.9	8.4	13.8	16.0	19.5	18.6	13.0
Michigan	13.4	16.1	14.8	13.8	8.4	7.6	11.1	17.7	15.5	9.8	18.5	13.1	14.5	18.0
Wisconsin	13.7	12.2	13.0	15.7	15.5	15.5	16.1	18.1	15.6	15.5	16.6	16.3	14.1	18.2
Minnesota	13.5	12.8	13.7	13.3	13.4	10.5	12.9	13.9	13.1	12.8	13.3	10.9	13.0	12.8
Iowa	12.6	10.2	12.9	14.1	13.0	15.6	16.2	12.7	12.4	11.6	14.2	15.7	13.4	17.2
Missouri	12.8	11.4	12.8	12.2	9.9	12.5	15.9	19.9	8.7	17.7	12.4	14.8	13.2	10.0
North Dakota	.....	.....	14.5	12.2	12.8	4.9	13.1	15.9	12.7	11.8	14.0	13.0	10.0	11.6
South Dakota	.....	.....	11.0	11.1	10.7	6.9	12.9	12.2	13.8	9.6	13.7	13.4	11.2	12.8
Nebraska	14.8	11.9	10.8	15.4	10.3	12.0	17.1	20.9	15.7	13.6	19.4	22.0	18.1	17.2
Kansas	15.7	13.9	12.8	13.7	9.8	17.7	18.5	10.4	14.1	12.4	13.9	15.1	11.0	12.6
Kentucky	9.2	9.7	11.2	11.2	9.1	13.0	12.1	9.3	8.4	11.4	11.3	14.1	12.0	11.6
Tennessee	7.7	6.6	8.3	9.5	8.7	9.9	10.8	7.2	7.1	11.5	7.2	12.5	9.5	10.0
Alabama	7.6	6.4	6.9	9.1	7.6	9.5	8.7	6.0	9.1	10.3	9.6	11.0	10.0	11.5
Mississippi	9.2	6.2	6.9	9.4	7.7	9.6	8.8	8.0	8.0	8.8	10.8	10.0	11.0	14.5
Texas	12.8	10.8	10.4	12.3	11.1	18.4	8.9	9.0	13.4	10.7	8.9	11.5	7.4	11.0
Oklahoma	.....	.....	11.4	14.1	13.3	19.0	15.8	11.3	14.5	12.1	8.5	13.7	9.0	11.6
Arkansas	10.3	7.1	8.6	9.1	8.6	10.1	8.8	9.1	7.0	10.1	7.9	10.8	9.5	10.0
Montana	.....	17.7	19.8	26.9	25.7	26.6	26.5	26.0	28.2	23.9	23.8	24.0	28.8	24.2
Wyoming	.....	17.0	20.1	22.6	18.8	17.6	24.5	23.5	20.9	22.1	25.4	28.7	28.5	25.4
Colorado	.....	19.1	19.2	23.1	23.7	22.6	24.1	18.0	26.6	22.8	25.0	32.5	29.0	21.0
New Mexico	.....	13.6	14.7	19.6	13.8	21.0	21.5	17.1	18.4	12.8	22.2	25.0	24.0	25.0
Arizona	.....	13.9	15.2	21.6	15.3	14.6	21.8	18.7	25.3	25.5	24.4	25.2	25.9	26.7
Utah	.....	18.0	17.6	23.4	20.7	20.9	20.5	21.2	22.6	26.6	26.4	27.4	28.8	26.5
Nevada	21.6	18.1	17.4	25.9	18.0	24.5	25.1	27.1	27.6	26.2	27.0	31.5	32.0	30.0
Idaho	.....	17.2	18.4	23.8	24.2	20.8	21.2	22.1	21.1	22.9	28.2	24.4	25.3	28.2
Washington	.....	16.3	17.6	23.0	22.7	23.5	29.1	22.2	20.3	22.2	24.6	20.8	26.0	18.8
Oregon	18.9	17.5	16.7	18.4	19.2	13.8	21.1	20.0	18.2	19.0	18.6	20.0	23.4	20.8
California	14.8	13.0	12.4	11.3	14.1	10.3	13.0	10.9	11.2	10.8	9.3	17.1	15.0	14.6
United States	11.9	12.3	12.7	13.5	12.3	12.3	15.0	14.5	12.9	12.5	14.5	15.5	14.0	14.0
Division:[a]														
North Atlantic	13.7	14.1	14.1	16.3	14.6	14.6	16.1	16.1	16.1	13.5	17.9	18.2	18.4	18.3
South Atlantic	8.9	8.9	9.0	10.6	9.5	12.4	11.6	8.6	8.8	10.5	11.0	12.4	14.3	12.3
N. Central E. of Miss. R.	12.3	13.9	14.2	13.3	11.4	9.1	15.3	17.1	11.6	11.7	17.3	19.1	15.8	15.6
N. Central W. of Miss. R.	13.1	11.9	13.0	13.0	11.7	11.6	14.9	14.7	13.2	12.0	14.2	14.2	12.2	12.7
South Central	8.6	8.2	9.7	11.5	10.6	14.7	12.1	9.3	11.4	11.4	8.8	12.8	9.7	11.1
Far Western	15.4	14.3	13.9	16.8	17.9	15.2	19.2	16.8	16.9	18.1	18.2	20.8	22.6	20.2

[a] See note *a*, page 599.

Average farm value per acre of wheat in the United States December 1.

State, Territory, or Division.	10-year averages.				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	22.04	19.32	16.43	21.22	20.47	17.55	23.18	23.28	24.99	24.23	24.38	25.05	26.50	24.50
N. Hampshire	24.78	20.59	15.96	17.54	16.34	15.00	......	......	......	......	......	......	......	......
Vermont	26.18	21.34	18.05	20.14	18.70	18.33	17.58	20.49	19.85	28.36	16.92	19.18	23.00	23.00
Connecticut	25.11	20.46	16.74	18.02	17.39	17.05	......	......	......	......	......	......	......	......
New York	20.02	17.67	13.24	14.70	14.80	13.63	10.74	13.27	14.42	12.32	18.06	16.40	17.13	17.32
New Jersey	21.32	15.56	11.52	13.36	10.88	14.13	12.10	12.16	11.48	14.63	14.43	14.64	18.13	17.47
Pennsylvania	18.09	14.87	11.15	12.64	8.98	9.72	12.31	11.53	12.32	15.23	14.88	13.45	17.86	18.32
Delaware	15.37	14.25	9.68	12.80	8.70	14.21	13.13	12.38	7.96	16.09	11.32	11.36	19.88	15.00
Maryland	14.84	14.34	10.77	12.72	9.59	13.84	12.21	10.58	9.88	14.20	13.37	11.36	18.24	16.07
Virginia	10.87	8.80	7.04	8.34	5.80	8.57	7.96	4.50	7.31	11.12	10.03	10.12	12.25	11.51
W. Virginia	11.43	11.02	8.24	8.96	6.60	7.55	8.39	6.31	8.67	11.01	10.95	10.29	12.20	13.39
N. Carolina	9.79	7.39	5.46	6.82	5.49	7.87	7.13	4.88	4.95	10.23	6.83	8.46	10.16	10.70
S. Carolina	10.68	8.98	5.70	8.01	6.44	9.09	8.62	5.71	6.56	10.21	6.77	10.23	10.20	11.70
Georgia	10.49	8.56	5.92	7.90	6.66	8.64	7.71	5.88	5.95	11.09	7.38	10.20	10.35	11.13
Ohio	14.40	14.89	10.66	10.76	9.09	4.26	10.86	12.14	10.96	12.65	14.02	14.48	15.00	15.84
Indiana	12.21	13.34	9.73	9.39	6.27	3.71	11.06	10.88	7.80	9.75	15.01	14.49	12.67	16.27
Illinois	11.66	11.92	9.87	9.62	6.30	8.32	12.14	10.56	6.30	13.94	12.96	13.46	15.66	12.61
Michigan	16.21	15.94	10.95	10.63	5.46	5.24	7.88	12.21	11.94	10.58	14.61	9.43	13.19	17.46
Wisconsin	12.06	10.86	8.84	11.15	9.46	9.92	10.48	11.61	11.22	15.18	12.65	11.73	12.95	16.73
Minnesota	9.04	10.11	8.77	8.78	7.37	6.62	7.74	8.48	9.04	11.14	9.44	7.08	11.96	12.03
Iowa	9.32	7.85	8.26	9.02	7.15	9.20	9.75	6.96	7.69	10.48	10.08	10.07	11.03	15.17
Missouri	13.18	9.92	8.19	8.66	6.14	7.88	10.97	11.54	6.18	11.23	9.80	9.92	11.09	9.30
North Dakota	......	......	7.10	7.56	6.53	2.84	7.07	9.22	8.00	9.56	9.66	8.19	8.70	10.67
South Dakota	......	......	5.50	6.77	5.35	4.00	6.84	6.95	8.56	7.58	9.18	8.17	9.97	11.78
Nebraska	10.06	8.33	6.05	9.09	5.05	6.36	9.23	10.23	8.47	11.83	12.81	12.54	14.31	14.47
Kansas	15.39	10.29	7.68	8.63	5.10	9.73	10.92	5.73	8.33	11.06	9.88	8.75	9.03	11.06
Kentucky	10.58	9.22	8.18	8.74	6.01	8.97	8.71	6.88	6.80	12.43	9.83	10.29	11.04	11.37
Tennessee	9.01	6.40	6.22	7.88	6.79	7.82	7.99	5.47	5.96	12.77	6.55	9.75	9.02	9.90
Alabama	10.41	7.49	6.69	8.64	6.76	8.45	7.66	5.58	8.65	11.85	9.70	10.34	10.51	12.29
Mississippi	13.98	7.87	6.42	8.37	6.01	8.06	7.57	6.80	7.44	8.89	10.26	8.70	9.50	14.00
Texas	17.66	11.12	8.11	9.84	7.55	11.78	6.94	6.93	10.45	11.77	7.83	8.85	7.33	10.78
Oklahoma	......	......	5.70	9.31	7.05	10.07	10.07	6.60	9.24	11.35	5.98	7.66	7.47	10.21
Arkansas	13.49	7.24	6.79	6.92	5.50	6.57	6.86	6.10	5.46	10.20	7.11	8.10	9.03	9.50
Montana	......	16.99	14.45	18.02	15.68	16.23	17.76	16.12	18.61	21.28	16.90	15.36	23.33	20.82
Wyoming	......	15.81	13.67	16.50	12.60	13.38	16.91	19.04	15.47	19.89	18.29	20.95	21.93	21.56
Colorado	......	17.76	13.25	15.48	13.51	13.33	16.15	13.50	17.56	22.75	17.50	21.13	22.62	18.48
New Mexico	......	15.23	12.05	14.90	8.42	14.28	15.48	14.71	13.80	13.57	19.98	20.75	22.33	23.51
Arizona	......	14.46	12.31	19.44	9.79	11.53	18.53	19.64	23.53	28.82	26.21	25.96	27.20	32.00
Utah	......	14.76	11.44	15.91	10.97	11.49	14.35	16.11	18.08	22.88	17.69	17.81	21.31	22.51
Nevada	34.99	19.37	13.40	22.02	13.68	17.15	22.09	25.56	27.32	24.10	20.79	26.77	33.27	33.91
Idaho	......	16.17	12.70	14.99	12.10	9.57	12.93	15.44	15.86	18.34	18.49	14.66	16.92	20.83
Washington	......	12.22	10.91	14.26	11.58	11.99	13.67	14.44	14.04	17.77	16.13	12.91	19.48	15.40
Oregon	16.25	14.52	11.02	12.14	10.18	7.59	11.37	13.37	13.98	15.37	12.68	13.26	18.29	17.48
California	16.72	13.00	8.80	8.59	8.74	5.97	7.80	8.72	9.74	9.50	7.63	12.82	14.70	14.89
United States	12.92	11.39	8.67	9.37	7.17	7.61	9.37	9.14	8.96	11.58	10.83	10.37	12.26	12.97
Division:[a]														
N. Atlantic	19.10	15.98	11.76	13.28	10.22	10.73	11.95	12.00	12.82	14.60	15.59	14.17	17.76	18.14
S. Atlantic	12.09	9.90	7.44	8.91	7.02	9.65	8.93	6.86	7.49	11.82	9.86	10.22	13.93	12.84
N. Central E. Miss. R.	13.11	13.32	10.11	10.17	7.28	6.06	10.70	11.38	9.00	12.27	14.00	13.44	13.94	15.21
N. Central W. Miss. R.	10.34	9.33	7.70	8.29	6.16	6.70	8.63	8.34	8.23	10.38	9.94	8.69	10.44	11.47
S. Central	10.29	8.08	7.28	8.68	6.77	9.52	8.52	6.45	8.36	11.83	7.29	8.87	8.86	10.53
Far Western	16.99	13.63	9.62	11.66	10.10	8.51	10.83	12.03	12.92	15.10	12.82	14.06	18.19	17.31

[a] See note *a*, page 599.

Average farm price of wheat per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	*1876–1885.*	*1886–1895.*	*1896–1905.*	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan. 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Maine	167	141	104	96	91	90	97	92	98	104	106	101	101	104	102	106	100	101	107	107
New Hampshire	163	141	101	98	95	92														
Vermont	154	127	96	95	85	78	94	109	95	113	90	86	100	99	100	80	100	105	105	100
Connecticut	146	124	104	91	95	82														
New York	142	114	86	84	80	77	82	79	81	109	86	82	99	99	98	98	99	98	94	97
New Jersey	146	117	86	83	75	74	72	76	82	110	88	80	98	101	97	95	100	97	97	101
Pennsylvania	136	111	82	80	66	72	72	73	79	108	87	76	96	99	97	96	96	95	92	96
Delaware	141	114	80	80	68	70	71	75	78	108	82	71	97	100	98	93	97	90	92	98
Maryland	140	112	81	80	68	71	71	72	79	106	82	71	96	98	97	94	95	89	92	97
Virginia	131	106	80	81	69	72	73	79	84	109	88	81	98	101	98	98	99	96	95	99
West Virginia	111	102	80	83	71	77	77	82	85	109	89	81	100	103	101	101	101	100	98	102
North Carolina	136	112	88	91	82	82	82	92	97	119	102	93	107	107	103	104	105	105	101	106
South Carolina	178	136	100	104	99	101	98	102	101	126	111	110	120	130	120	110	125	120	123	125
Georgia	152	124	97	100	98	95	94	98	96	126	107	102	115	121	115	117	115	112	117	121
Ohio	120	102	74	78	64	71	71	71	80	110	82	71	92	99	94	93	93	87	89	96
Indiana	111	96	70	77	64	70	70	68	78	106	82	70	88	98	91	91	90	84	87	95
Illinois	98	91	69	74	63	64	69	59	75	101	81	69	87	97	90	88	90	86	89	93
Michigan	121	99	74	77	65	69	71	69	77	108	79	72	91	97	93	93	94	90	89	95
Wisconsin	88	89	68	71	61	64	65	64	72	98	76	72	92	92	92	92	95	94	92	92
Minnesota	67	79	64	66	55	63	60	61	69	87	71	65	92	94	95	94	95	96	94	93
Iowa	74	77	64	64	55	59	60	55	62	90	71	64	82	88	85	83	86	85	84	87
Missouri	103	87	64	71	62	63	69	58	71	96	79	67	84	93	87	87	89	85	86	90
North Dakota			49	62	51	58	54	58	63	81	69	63	87	92	91	92	90	93	90	90
South Dakota			50	61	50	58	53	57	62	79	67	61	89	92	92	89	91	93	90	86
Nebraska	68	70	56	59	49	53	54	49	54	87	66	57	79	84	82	81	82	82	79	83
Kansas	98	74	60	63	52	55	59	55	59	89	71	58	82	88	82	85	85	82	82	87
Kentucky	115	95	73	78	66	69	72	74	81	109	87	73	92	98	93	95	95	92	92	98
Tennessee	117	97	75	83	78	79	74	76	84	111	91	78	95	99	95	98	98	96	95	99
Alabama	137	117	97	95	89	89	88	93	95	115	101	94	105	107	105	102	103	105	104	105
Mississippi	152	127	93	89	78	84	86	85	93	101	95	87	88	103	100		100	105	96	103

Texas	138	103	78	80	68	64	78	77	78	110	88	77	99	98	96	97	99	95	90	95
Oklahoma	......	......	50	66	53	54	64	59	64	94	70	56	83	88	83	87	85	83	81	87
Arkansas	131	102	79	76	64	65	78	67	78	101	90	75	95	95	96	98	97	95	95	94
Montana	......	96	73	67	61	61	67	62	66	89	71	64	81	86	80	80	83	85	95	84
Wyoming	......	93	68	73	67	76	69	81	74	90	72	73	77	85	85	95	80	96	96	84
Colorado	......	93	69	67	57	59	67	75	66	91	70	65	78	88	75	78	81	87	86	89
New Mexico	......	112	82	76	61	68	72	86	75	106	90	83	93	94	105	90	95	96	83	95
Arizona	......	104	81	90	64	79	85	105	93	113	117	103	105	120	113	123	115	117	106	114
Utah	......	82	65	68	53	55	70	76	80	86	67	65	74	85	78	73	83	94	83	83
Nevada	162	107	77	85	76	70	88	98	99	92	77	85	104	113	117	104	110	127	125	109
Idaho	......	94	69	63	50	46	61	70	75	80	66	60	67	74	65	68	71	78	74	74
Washington	......	75	62	62	51	51	47	65	69	80	65	62	75	82	70	78	72	78	79	82
Oregon	86	83	66	66	53	55	54	67	77	81	68	66	78	84	74	79	75	79	85	83
California	113	100	71	76	62	58	60	80	87	88	82	75	98	102	95	97	95	99	95	102
United States	108.6	92.6	68.3	69.4	58.4	61.9	62.4	63.0	69.5	92.4	74.8	66.7	87.4	92.8	88.7	89.2	89.3	89.5	88.7	91.5
Division:[a]																				
North Atlantic	139.4	113.3	83.4	81.5	70.0	73.3	74.2	74.7	79.8	108.3	86.9	77.7	96.7	99.1	97.2	96.3	96.8	95.7	92.7	96.5
South Atlantic	135.8	111.2	82.7	84.1	73.6	77.5	77.1	80.2	85.4	112.1	89.6	82.7	97.2	104.4	101.2	99.6	101.5	100.1	100.5	104.8
N. Central E. of Miss. R.	106.6	95.8	71.2	76.5	63.7	66.6	69.8	66.5	77.4	104.7	80.9	70.3	88.1	97.7	91 7	90.8	91.3	86.3	88.5	94.6
N. Central W. of Miss. R.	78.9	78.4	59.2	63.8	52.8	58.0	57.9	56.7	62.4	86.4	70.0	61.4	85.6	90.3	88.2	88.2	88.7	89.0	87.3	88.7
South Central	119.7	98.5	75.0	75.5	64.0	64.8	70.4	69.2	73.3	103.9	82.8	69.2	91.3	94.9	91.4	93.8	93.6	91.1	89.6	94.4
Far Western	110.3	95.3	69.2	69.4	56.5	55.9	56.4	71.7	76.4	83.6	70.3	67.4	80.6	85.7	77.6	81.6	79.7	86.8	86.1	88.7

[a] See note a, page 599.

Wholesale prices of wheat per bushel, 1895–1908.

Date.	New York.		Baltimore.		Chicago.		Detroit.		St. Louis.		Minneapolis.		San Francisco.	
	No. 2 red winter.		Southern, No. 2 red.[a]		No. 1 northern spring.[b]		No. 2 red.		No. 2 red winter.		No. 1 northern.[c]		No. 1 California (per cwt.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		
1895	55½	84	55	83	48⅞	81½	52½	86	48¾	85½	50	80¾	$0.81¼	$1.02½
1896	62	106⅞	51	96	54	82	57½	97	[illegible]	92⅝	50	81½	.92½	1.50
1897	81⅝	111¼	50	107½	64⅛	109	74½	101	65½	103	65¼	107½	1.21¼	1.56¼
1898	68¾	193½	60	146½	62	185	65½	160	64	127	55	155	1.08¾	1.80
1899	72¼	87½	68½	81½	64	79½	67½	80¼	68	81⅝	60	73⅞	.96¼	1.18¾
1900	72⅞	96⅞	70	90	61½	87½	66¾	91½	66¼	86½	62	88⅞	.90	1.07½
1901	72¾	89⅞	60¼	85¼	63⅛	79½	66½	90½	61¼	88½	60½	77½	.95	1.06¼
1902	73½	94¼	66¼	87½	67½	95	68½	93½	63	[illegible]	66½	80⅜	1.05	1.45
1903	78¼	99⅞	76½	88¾	70¼	93	74¼	94	69¾	94	73⅛	100	1.32½	1.55
1904	92½	126¼	82	118½	81¼	122	92	123	84½	121	84¾	124½	1.23¾	1.50
1905.														
January	118⅞	125¾	101¾	119½	118	121	119	123½	114	120	108½	113½	1.45	1.52½
February	120¼	125¼	101½	117½	115	124	117½	124	116½	119½	107¾	112¾	1.50	1.55
March	114⅛	121⅜	98	114½	112	118¾	107½	121	111	117	105	111⅞	1.50	1.55
April	91½	115	83	109½	88½	118	96	107½	98	112½	91⅝	108⅛	1.45	1.55
May	91½	111½	83½	107½	89½	113¾	97	108	98	113½	95⅝	124½	1.45	1.55
June	103⅜	114¼	73	103½	107⅜	120	100	109	92	107	104	109¼	1.50	1.55
July	90	109¼	75	92	112	120	86	105	83½	95½	101¼	109¼	1.50	1.55
August	84¾	91⅛	76	84½	103	115	81	84	82½	88	83½	111	1.45	1.55
September	85⅝	91⅜	75¾	84½	88	95	82¼	85¾	82	90	75¼	80	1.40	1.55
October	88¼	99	76½	86½	86	92¼	80	90½	88	95	78⅜	87⅛	1.40	1.45
November	90	98¼	76	85¼	85	92	87¼	90½	89	95	79	84½	1.40	1.45
December	92¾	101	78	87	82½	90	86	89	90½	96½	77¾	81¾	1.35	1.45
1906.														
January	89½	97	84	86¾	81¼	85¼	85	88	92	96	81	84⅛	......	......
February	90⅛	96½	84½	86¾	79¼	83½	84	86½	88	95⅝	78½	83½	......	......
March	85	89¼	81	84¾	74½	79½	81	86	89	94	74⅞	78⅞	......	......
April	88¼	92¼	83	88¾	77½	83	85½	89	90	98	76⅝	81⅛	......	......
May	93	95	86¾	89½	80¼	87¼	89¼	93½	88	99¼	78⅜	84¾	......	......
June	91⅞	97	87¼	91	81⅝	85¾	86	89¼	86	95	82⅛	85⅜	......	......
July	81	92⅜	75¾	81¾	75¾	84	74¾	85½	71¾	82	76⅛	82	......	......
August	77¼	81½	71	75	73⅝	77⅞	72¼	75	68⅛	72½	73¼	77½	......	......
September	77	81	68	74⅛	77	79	72	75¼	69	76	69⅝	78⅜	......	......
October	78½	83⅛	74	75⅜	d71	d73¾	74¾	78¼	74	77½	74½	77⅝	......	......
November	80½	84¼	73½	75½	d71⅝	d74¼	77½	78½	74	76½	77⅛	82¼	......	......
December	80¼	83	73⅜	75	d72⅝	d75	76⅜	78¼	74	76½	77⅝	81⅜	......	......
1907.														
January	80	84	74	78½	......	......	75	78¼	74½	79¼	76¾	83⅝	1.22½	1.40
February	83	85¾	77½	81	82	87	77	79¼	76½	80	79¼	85⅛	1.25	1.35
March	80¾	85	75¾	77½	79	86½	76	78¼	75½	79	78½	81½	1.25	1.40
April	[illegible]	91	77½	84	80	87	77¼	82½	75½	81½	79⅜	86⅛	1.27½	1.50
May	87	108⅞	84	99½	84	106	81	103	80½	101	87	105⅜	1.35	1.55
June	94¾	104¾	90¼	96¼	98	105	93	99¼	90½	100	96⅞	104⅞	1.42½	1.55
July	96⅝	105⅜	89½	96	100	106½	91¼	99	87½	96½	98	105¼	1.50	1.60
August	91	100⅝	85⅞	94½	93	105	83½	92¼	81	91	94¾	105⅛	1.50	1.60
September	100⅛	108¼	96⅝	104¼	105	112	92¼	99	89½	101¼	104½	111½	1.55	1.70
October	104¾	116¼	99¾	111¼	108	122	97¾	106½	96	100½	103¼	119¾	1.60	1.77½
November	94¾	108½	97¼	102½	......	......	94¼	100¼	90	99	98	107⅛	1.65	1.80
December	104¼	109	97½	104¼	......	......	97¾	104¼	96	105	103¼	111¼	1.60	1.77½
1908.														
January	100	109¼	94¾	104	......	......	95¼	105	99	106¼	105⅝	114½	1.60	1.72½
February	96⅝	104⅜	92	100½	......	......	94½	103½	96	104	101⅞	110¾	1.55	1.70
March	99¾	106¼	95½	99¾	105	108	94¾	103¾	97	106	103¼	111½	1.60	1.70
April	96⅝	109⅛	93¾	100½	105	107	92½	101½	96	102	98¾	108	1.60	1.70
May	103	111½	97½	103	......	......	97	104	100	106	106⅛	111⅞	1.63¾	1.75
June	95¾	103	89	99	107	112	89¾	97	89	101½	105⅝	110⅞	1.60	1.72½
July	96⅝	102¾	91	99	115	119	90	92½	89	93½	107¾	121	1.60	1.70
August	99⅝	105½	96	99⅝	108	124	93½	96	91½	97½	99⅞	125	1.65	1.72½
September	102¼	110¼	96⅞	104¼	105	109	96	101¾	97	106	100⅞	105⅝	1.65	1.77½
October	106¼	110⅝	101⅛	103½	102	108	100	103	100½	106½	102⅛	105	1.62½	1.75
November	109¼	114½	101¼	105⅜	104	110	102	106	101¾	109	104⅛	108⅜	1.65	1.72½
December	107⅜	115	101¼	106⅜	106½	112	102½	107	106	110	106⅛	112½	1.65	1.72½

[a] Southern for 1895 and 1896.
[b] No. 2 spring, for 1895 and 1896; no grade, 1897 to 1901.
[c] No. 2 northern, 1895 to 1900.
[d] No. 2 red winter.

International trade in wheat, 1903–1907. [a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	61,778,175	84,684,087	105,391,256	82,599,397	98,502,584
Australia	Jan. 1	1,209,800	34,113,906	25,424,969	30,262,335	28,784,130
Austria-Hungary	Jan. 1	603,379	117,282	49,321	1,118,588	[b] 682,738
Belgium	Jan. 1	11,751,205	14,803,681	14,639,453	16,051,913	17,852,194
British India	Jan. 1	43,016,837	75,256,004	47,680,406	26,488,483	37,515,771
Bulgaria	Jan. 1	12,234,810	19,240,949	16,542,617	9,856,687	8,845,503
Canada	Jan. 1	28,031,265	16,618,309	28,669,571	38,135,023	37,503,057
Chile	Jan. 1	1,979,146	2,718,470	294,656	8,065	1,297,765
Germany [c]	Jan. 1	6,626,109	5,864,239	6,050,111	7,365,175	3,520,763
Netherlands	Jan. 1	39,740,530	40,681,553	53,052,451	33,126,858	44,717,615
Roumania	Jan. 1	30,611,933	26,107,148	63,066,299	63,485,127	[d] 63,485,127
Russia	Jan. 1	153,448,855	169,058,193	176,852,636	132,410,638	[b] 85,034,810
Servia	Jan. 1	1,841,636	3,056,539	3,422,554	3,365,644	1,992,514
United States	Jan. 1	73,372,755	13,015,277	20,738,635	62,850,984	91,383,648
Other countries	....	4,547,835	5,294,161	5,706,970	6,038,597	[b] 9,768,239
Total	....	470,794,270	510,629,798	567,581,905	513,163,514	530,886,458

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Austria-Hungary	Jan. 1	824,753	8,057,794	3,974,199	1,216,790	[b] 87,535
Belgium	Jan. 1	59,497,821	63,979,307	64,789,991	67,928,168	67,469,371
Brazil	Jan. 1	6,200,299	7,112,130	7,873,510	8,511,259	9,070,293
Denmark	Jan. 1	3,686,313	3,861,670	3,447,367	4,168,334	2,820,299
France	Jan. 1	17,365,172	7,580,618	6,713,342	11,288,433	[b] 13,131,250
Germany [c]	Jan. 1	70,882,595	74,263,743	84,054,403	73,784,363	90,200,107
Greece	Jan. 1	6,109,739	5,132,775	5,733,503	7,426,048	7,454,387
Italy	Jan. 1	43,115,829	29,617,847	43,047,890	50,473,571	[b] 34,281,799
Japan	Jan. 1	2,812,509	888,558	2,281,022	789,540	2,008,998
Netherlands	Jan. 1	49,668,874	50,510,097	61,992,589	44,506,710	53,704,405
Portugal	Jan. 1	2,748,269	3,282,298	4,672,573	3,853,239	[d] 3,853,239
Spain	Jan. 1	3,336,229	8,192,327	32,517,661	19,312,985	4,289,189
Sweden	Jan. 1	8,238,201	8,082,561	7,255,222	7,838,974	5,656,901
Switzerland	Jan. 1	16,324,627	17,220,343	16,158,553	16,196,009	17,211,259
United Kingdom	Jan. 1	164,206,362	181,984,062	181,579,837	172,808,565	180,443,017
Other countries	....	24,954,900	11,475,686	14,032,454	18,299,933	[b] 16,802,414
Total	....	479,972,492	481,241,816	540,124,116	508,402,921	508,484,563

[a] See "General note," p. 605.
[b] Preliminary.
[c] Not including free ports prior to March 1, 1906.
[d] Year preceding.

International trade in wheat flour, 1903–1907. [a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
Argentina	Jan. 1	809,636	1,206,896	1,628,271	1,450,979	1,434,118
Australia	Jan. 1	62,214	1,052,500	1,573,663	1,702,801	1,667,722
Austria-Hungary	Jan. 1	1,095,357	859,446	795,853	658,449	[b] 658,584
Belgium	Jan. 1	358,132	758,648	857,017	439,659	442,303
British India	Jan. 1	432,017	574,379	577,961	417,984	476,995
Bulgaria	Jan. 1	211,311	232,315	214,587	261,974	293,509
Canada	Jan. 1	1,686,819	1,399,555	1,278,770	1,516,170	1,858,483
Chile	Jan. 1	64,796	95,099	91,617	50,008	42,207
Germany [c]	Jan. 1	295,698	616,939	991,701	663,437	987,604
Netherlands	Jan. 1	106,207	130,372	199,777	110,985	159,970
Roumania	Jan. 1	277,557	135,900	484,511	745,296	[d] 745,296
Russia	Jan. 1	1,025,773	1,172,442	1,090,480	1,131,591	[b] 622,762
Servia	Jan. 1	38,827	9,286	21,794	86,885	33,570
United States	Jan. 1	19,555,311	11,542,618	11,344,432	14,324,100	15,276,506
Other countries	....	1,058,530	1,258,033	1,646,505	1,582,683	[b] 1,892,966
Total	....	27,078,185	21,044,428	22,796,939	25,143,001	26,592,595

[a] See "General note," p. 605.
[b] Preliminary.
[c] Not including free ports prior to March 1, 1906.
[d] Year preceding.

International trade in wheat flour, 1903–1907—Continued.

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
China	Jan. 1	533,136	654,307	633,851	1,214,069	3,002,982
Cuba	Jan. 1	564,201	645,736	764,024	735,950	861,865
Belgium	Jan. 1	66,507	40,255	41,516	55,601	48,735
Brazil	Jan. 1	1,317,531	1,474,049	1,579,954	1,731,596	1,915,018
Denmark	Jan. 1	395,713	335,896	276,489	328,972	384,268
Egypt	Jan. 1	762,364	886,729	1,365,764	1,684,257	1,582,387
Finland	Jan. 1	764,152	757,085	794,748	879,955	963,974
France	Jan. 1	255,777	232,150	140,854	98,572	[a] 197,297
Germany [b]	Jan. 1	359,704	260,600	240,560	242,116	221,301
Greece	Jan. 1	21,762	16,584	28,942	110,867	60,923
Italy	Jan. 1	13,085	11,700	12,513	15,043	[a] 18,605
Japan	Jan. 1	1,411,611	1,291,886	1,242,854	1,082,671	838,641
Netherlands	Jan. 1	1,974,151	1,868,040	1,863,924	2,260,321	1,908,957
Spain	Jan. 1	6,002	13,694	663,272	161,765	[a] 695
Sweden	Jan. 1	93,494	80,852	57,839	83,949	125,421
United Kingdom	Jan. 1	11,754,350	8,384,319	6,779,921	8,024,846	7,565,526
Other countries	....	5,896,856	3,699,246	4,803,868	5,410,619	[a] 5,383,258
Total	....	26,190,396	20,653,128	21,290,893	24,121,169	25,079,853

[a] Preliminary. [b] Not including free ports prior to March 1, 1906.

International trade in wheat, including wheat flour, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	65,421,537	90,115,119	112,718,476	89,128,803	104,956,115
Australia	Jan. 1	1,489,763	38,850,166	32,506,453	37,924,939	36,288,879
Austria-Hungary	Jan. 1	5,532,485	3,984,789	3,630,659	4,081,608	[b] 3,646,366
Belgium	Jan. 1	13,362,799	18,217,597	18,496,029	18,030,379	19,842,558
British India	Jan. 1	44,960,913	77,840,710	50,281,230	28,369,411	39,662,249
Bulgaria	Jan. 1	13,185,710	20,286,368	17,508,259	11,035,570	10,166,293
Canada	Jan. 1	35,621,951	22,916,307	34,424,036	44,957,788	45,866,231
Chile	Jan. 1	2,270,728	3,146,416	706,932	233,101	1,487,697
Germany [c]	Jan. 1	7,956,750	8,640,465	10,512,765	10,350,641	7,964,981
Netherlands	Jan. 1	40,218,462	41,268,227	53,951,447	33,626,290	45,437,480
Roumania	Jan. 1	31,860,939	26,718,698	65,246,599	66,838,959	[d] 66,838,959
Russia	Jan. 1	158,064,833	174,334,182	181,759,796	137,502,798	[b] 87,837,234
Servia	Jan. 1	2,016,358	3,098,326	3,520,627	3,756,626	2,143,579
United States	Jan. 1	161,371,655	64,957,058	71,788,579	127,309,434	160,127,925
Other countries	....	9,311,220	10,955,307	13,116,243	13,160,671	[b] 18,286,589
Total	....	592,646,103	605,329,735	670,168,130	626,307,018	650,553,135

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Belgium	Jan. 1	59,797,102	64,160,454	64,976,813	68,178,372	67,688,679
Brazil	Jan. 1	12,129,189	13,745,351	14,983,303	16,303,441	17,687,874
China	Jan. 1	2,399,112	2,944,382	2,852,330	5,463,370	13,513,419
Cuba	Jan. 1	2,538,905	2,905,812	3,438,108	3,311,775	3,878,392
Denmark	Jan. 1	5,467,021	5,373,202	4,691,567	5,648,708	4,549,501
Egypt	Jan. 1	3,689,192	4,353,796	7,247,951	8,293,376	7,701,728
Finland	Jan. 1	3,442,443	3,413,761	3,580,581	3,966,878	4,397,732
France	Jan. 1	18,516,169	8,625,293	7,347,185	11,732,007	[b] 14,019,086
Germany [c]	Jan. 1	72,501,263	75,436,443	85,136,923	74,873,885	91,195,961
Greece	Jan. 1	6,207,668	5,207,403	5,863,742	7,924,950	7,728,541
Italy	Jan. 1	43,174,711	29,670,497	43,104,199	50,541,265	[b] 34,365,521
Japan	Jan. 1	9,164,759	6,702,045	7,873,865	5,661,560	5,782,882
Netherlands	Jan. 1	58,552,553	58,916,277	70,380,247	54,678,154	62,294,711
Portugal	Jan. 1	2,748,269	3,282,298	4,672,573	3,853,239	[d] 3,853,239
Spain	Jan. 1	3,363,238	8,253,950	35,502,385	20,040,927	[b] 4,292,317
Sweden	Jan. 1	8,658,924	8,446,395	7,515,498	8,216,744	6,221,294
Switzerland	Jan. 1	16,324,627	17,220,343	16,158,553	16,196,009	17,211,359
United Kingdom	Jan. 1	217,100,937	219,713,497	212,089,481	208,920,372	214,487,884
Other countries	....	52,053,192	35,809,693	38,517,829	43,143,210	[b] 40,473,781
Total	....	597,829,274	574,180,892	635,933,133	616,948,182	621,343,901

[a] See "General note," p. 605.
[b] Preliminary.
[c] Not including free ports prior to March 1, 1906.
[d] Year preceding.

OATS.

Oat crop of countries named, 1904–1908.

Country.	1904.	1905.	1906.	1907.	1908.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	894,596,000	953,216,000	964,905,000	754,443,000	807,156,000
Canada:					
New Brunswick	5,316,000	5,659,000	5,875,000	7,503,000	5,216,000
Ontario	105,393,000	108,890,000	111,756,000	86,157,000	107,093,000
Manitoba	37,434,000	46,917,000	52,291,000	43,469,000	46,120,000
Saskatchewan	11,095,000	19,819,000	24,721,000	24,060,000	30,125,000
Alberta	5,786,000	9,814,000	13,551,000	8,254,000	23,521,000
Other	43,000,000	43,000,000	43,000,000	53,378,000	46,193,000
Total Canada	208,024,000	234,099,000	251,194,000	222,821,000	258,268,000
Mexico	18,000	17,000	17,000	17,000	17,000
Total North America	1,102,638,000	1,187,332,000	1,216,116,000	977,281,000	1,065,441,000
EUROPE.					
Austria-Hungary:					
Austria	109,611,000	123,880,000	154,551,000	170,605,000	144,363,000
Hungary proper	62,775,000	78,009,000	87,733,000	79,484,000	70,168,000
Croatia-Slavonia	4,907,000	6,075,000	5,541,000	4,736,000	4,271,000
Bosnia-Herzegovina	3,829,000	2,935,000	3,543,000	2,575,000	3,572,000
Total Austria-Hungary	181,122,000	210,899,000	251,368,000	257,400,000	222,374,000
Belgium	37,499,000	33,786,000	45,228,000	46,144,000	44,000,000
Bulgaria	11,179,000	9,381,000	11,884,000	7,416,000	8,500,000
Denmark	37,165,000	31,763,000	38,726,000	42,529,000	41,000,000
Finland	16,995,000	18,060,000	18,000,000	18,000,000	19,000,000
France	257,811,000	269,581,000	256,943,000	303,889,000	287,190,000
Germany	477,852,000	451,017,000	580,875,000	630,324,000	530,131,000
Italy	14,000,000	16,000,000	18,000,000	20,000,000	18,000,000
Netherlands	18,592,000	16,045,000	19,588,000	20,933,000	21,000,000
Norway	6,922,000	9,868,000	9,297,000	6,946,000	11,315,000
Roumania	12,608,000	18,974,000	26,165,000	17,842,000	17,212,000
Russia:					
Russia proper	1,006,102,000	767,550,000	544,933,000	729,813,000	743,506,000
Poland	44,393,000	61,933,000	66,425,000	72,574,000	66,136,000
Northern Caucasia	14,573,000	22,184,000	21,933,000	19,697,000	24,860,000
Total Russia (European)	1,065,068,000	851,667,000	633,291,000	822,084,000	834,502,000
Servia	3,167,000	3,549,000	4,642,000	2,984,000	3,000,000
Spain	18,500,000	22,250,000	28,077,000	16,998,000	28,114,000
Sweden	51,578,000	58,488,000	64,550,000	67,741,000	72,773,000
United Kingdom:					
Great Britain—					
England	86,728,000	76,453,000	84,102,000	94,606,000	82,470,000
Scotland	37,034,000	36,390,000	35,108,000	36,193,000	37,920,000
Wales	7,661,000	7,264,000	8,063,000	7,829,000	7,133,000
Ireland	60,142,000	60,754,000	62,751,000	50,850,000	63,839,000
Total United Kingdom	191,565,000	180,861,000	190,024,000	189,478,000	191,362,000
Total Europe	2,401,623,000	2,202,189,000	2,196,658,000	2,470,708,000	2,349,473,000
ASIA.					
Cyprus	417,000	402,000	359,000	331,000	340,000
Russia:					
Central Asia	8,014,000	14,279,000	9,805,000	18,049,000	18,540,000
Siberia	51,101,000	70,672,000	69,873,000	67,114,000	89,500,000
Transcaucasia [a]	20,000	44,000	35,000	13,000	27,000
Total Russia (Asiatic)	59,135,000	84,995,000	79,713,000	85,176,000	108,067,000
Total Asia	59,552,000	85,397,000	80,072,000	85,507,000	108,407,000
AFRICA.					
Algeria	6,631,000	7,036,000	9,379,000	10,651,000	8,500,000
Cape of Good Hope	2,503,000	3,000,000	3,000,000	3,000,000	2,596,000

[a] Includes Chernomorsk only.

Oat crops of countries named, 1904–1908—Continued.

Country.	1904.	1905.	1906.	1907.	1908.
AFRICA—continued.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Natal	43,000	9,000	7,000	5,000	5,000
Tunis	4,635,000	2,032,000	2,411,000	3,149,000	1,135,000
Total Africa	13,812,000	12,077,000	14,797,000	16,805,000	12,236,000
AUSTRALASIA.					
Australia:					
Queensland	73,000	16,000	6,000	30,000	10,000
New South Wales	1,292,000	673,000	911,000	1,449,000	879,000
Victoria	13,858,000	6,353,000	7,460,000	9,124,000	5,365,000
South Australia	931,000	573,000	897,000	924,000	902,000
Western Australia	267,000	233,000	293,000	472,000	712,000
Tasmania	1,673,000	1,216,000	1,238,000	2,042,000	1,574,000
Total Australia	18,094,000	9,064,000	10,805,000	14,041,000	9,472,000
New Zealand	15,583,000	15,012,000	13,108,000	11,555,000	15,495,000
Total Australasia	33,677,000	24,076,000	23,913,000	25,596,000	24,967,000
Grand total	3,611,302,000	3,511,071,000	3,531,556,000	3,575,897,000	3,560,524,000

Condition of the oat crop in the United States on the first of months named, 1888–1908.

Year.	June.	July.	August.	When harvested.	Year.	June.	July.	August.	When harvested.	Year.	June.	July.	August.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1888	95.4	95.2	91.7	87.2	1895	84.3	83.2	84.5	86.0	1902	90.6	92.1	89.4	87.2
1889	93.8	94.1	92.3	90.0	1896	98.8	96.3	77.3	74.0	1903	85.5	84.3	79.5	75.7
1890	89.8	81.6	70.1	64.4	1897	89.0	87.5	86.0	84.6	1904	89.2	89.8	86.6	85.6
1891	85.1	87.6	89.5	90.7	1898	98.0	92.8	84.2	79.0	1905	92.9	92.1	90.8	90.3
1892	88.5	87.2	86.2	78.9	1899	88.7	90.0	90.8	87.2	1906	85.9	84.0	82.8	81.9
1893	88.9	88.8	78.3	74.9	1900	91.7	85.5	85.0	82.9	1907	81.6	81.0	75.6	65.5
1894	87.0	77.7	76.5	77.8	1901	85.3	83.7	73.6	72.1	1908	92.9	85.7	76.8	69.7

Average yield of oats in countries named, bushels per acre, 1888–1907.

Year.	United States. [a]	Russia, European. [b]	Germany. [b]	Austria. [b]	Hungary proper. [b]	France. [a]	United Kingdom. [a]
Average (1888 to 1897)	25.7	16.8	36.9	23.9	25.3	29.2	43.1
1898	28.4	16.2	47.1	27.4	30.2	29.0	46.1
1899	30.2	23.1	48.0	30.2	33.3	27.8	44.2
1900	29.6	20.0	48.0	25.2	28.1	25.7	43.5
1901	25.8	14.4	44.6	25.6	28.1	23.5	42.9
1902	34.5	21.8	50.1	27.7	34.0	29.2	48.3
1903	28.4	17.7	51.2	28.3	34.5	31.6	44.2
1904	32.1	25.7	46.2	24.3	25.6	27.2	44.2
1905	34.0	20.2	43.6	27.7	31.1	28.6	43.9
1906	31.2	15.1	55.7	34.1	34.3	27.0	46.1
1907	23.7	19.7	58.2	35.7	29.7	31.8	45.1
Average (1898 to 1907)	29.8	19.4	49.3	28.6	30.9	28.1	44.7

[a] Winchester bushels. [b] Bushels of 32 pounds.

Acreage, production, value, prices, exports, etc., of oats in the United States, 1849–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2.				Domestic exports, including oatmeal, fiscal year beginning July 1.[a]	Imports during fiscal year beginning July 1.[a]
						December.		May of following year.			
						Low.	High.	Low.	High.		
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1849[b]	....	......	146,584,179	......	....	......	......	......	......	....	....
1859[b]	....	......	172,643,185	......	....	......	......	......	......	....	....
1866	8,864,219	30.2	268,141,077	35.1	94,057,945	36	43	59	78	825,895	778,198
1867	10,746,416	25.9	278,698,000	44.5	123,902,556	52	57¼	......	......	122,554	780,798
1868	9,665,736	26.4	254,960,800	41.7	106,355,976	43	49½	56¾	62½	481,871	326,659
1869	9,461,441	30.5	288,334,000	38.0	109,521,734	40	44¾	46½	53½	121,517	2,266,785
1870	8,792,395	28.1	247,277,400	39.0	96,443,637	37¾	41	47¼	51	147,572	599,514
1871	8,365,809	30.6	255,743,000	36.2	92,591,359	30¾	33	34¼	42½	262,975	535,250
1872	9,000,769	30.2	271,747,000	29.9	81,303,518	23½	25¾	30	34	714,072	225,555
1873	9,751,700	27.7	270,340,000	34.6	93,474,161	34	40⅞	44	48½	812,873	191,802
1874	10,897,412	22.1	240,369,000	47.1	113,133,934	51¾	54½	57¼	64½	504,770	1,500,040
1875	11,915,075	29.7	354,317,500	32.0	113,441,491	29½	30½	28⅝	31½	1,466,228	121,547
1876	13,358,908	24.0	320,884,000	32.4	103,844,896	31¾	34½	37¼	45¾	2,854,128	41,597
1877	12,826,148	31.7	406,394,000	28.4	115,546,194	24⅛	27	23	27	3,715,479	21,391
1878	13,176,500	31.4	413,578,560	24.5	101,752,468	19⅝	20⅜	24⅜	30½	5,452,136	13,395
1879	12,683,500	28.7	363,761,320	33.1	120,533,294	32¾	36¾	29½	34⅞	766,366	489,576
1880	16,187,977	25.8	417,885,380	36.0	150,243,565	29⅛	33½	36¼	39½	402,904	64,412
1881	16,831,600	24.7	416,481,000	46.4	193,198,970	43½	46¾	48¾	56⅜	625,690	1,850,983
1882	18,494,691	26.4	488,250,610	37.5	182,978,022	34¾	41½	38¾	42¾	461,496	815,017
1883	20,324,962	28.1	571,302,400	32.7	187,040,264	29⅜	36⅛	30¼	34¼	3,274,622	121,069
1884	21,300,917	27.4	583,628,000	27.7	161,528,470	22½	25¼	34½	37	6,203,104	94,310
1885	22,783,630	27.6	629,409,000	28.5	179,631,860	27	29	26¼	29⅝	7,311,306	149,480
1886	23,658,474	26.4	624,134,000	29.8	186,137,930	25¾	27¼	25⅛	27½	1,374,635	139,575
1887	25,920,906	25.4	659,618,000	30.4	200,699,790	28⅝	30⅞	32½	38	573,080	123,817
1888	26,998,282	26.0	701,735,000	27.8	195,424,240	25	26⅞	21⅝	23⅝	1,191,471	131,501
1889	27,462,316	27.4	751,515,000	22.9	171,781,008	20	21	24¾	30	15,107,238	153,232
1890	26,431,369	19.8	523,621,000	42.4	222,048,486	39⅞	43⅞	45¼	54	1,382,836	41,848
1891	25,581,861	28.9	738,394,000	31.5	232,312,267	31⅛	33⅝	28⅛	33½	10,586,644	47,782
1892	27,063,835	24.4	661,035,000	31.7	209,253,611	25⅝	31¼	28¾	32¼	2,700,793	49,433
1893	27,273,033	23.4	638,854,850	29.4	187,576,092	27½	29⅛	32½	36	6,290,229	31,759
1894	27,023,553	24.5	662,036,928	32.4	214,816,920	28¾	29⅜	27½	30¾	1,708,824	330,318
1895	27,878,406	29.6	824,443,537	19.9	163,655,068	16⅝	17½	18	19⅜	15,156,618	66,602
1896	27,565,985	25.7	707,346,404	18.7	132,485,033	16½	18¾	16⅞	18¾	37,725,083	131,204
1897	25,730,375	27.2	698,767,809	21.2	147,974,719	21	23⅞	26	32	73,880,307	25,093
1898	25,777,110	28.4	730,906,643	25.5	186,405,364	26	27¾	24	27¾	33,534,362	28,098
1899	26,341,380	30.2	796,177,713	24.9	198,167,975	22¼	23	21¼	23¾	45,048,857	54,576
1900	27,364,795	29.6	809,125,989	25.8	208,669,233	21¾	22¾	27⅞	31	42,268,931	32,107
1901	28,541,476	25.8	736,808,724	39.9	293,658,777	42	48¼	41	49½	13,277,612	38,978
1902	28,653,144	34.5	987,842,712	30.7	303,584,852	29¼	32	33⅜	38¼	8,381,805	150,065
1903	27,638,126	28.4	784,094,199	34.1	267,661,665	34¼	38	39⅝	44¾	1,960,740	183,983
1904	27,842,669	32.1	894,595,552	31.3	279,900,013	28¼	32	[c] 28⅝	[c] 32	8,394,692	55,699
1905	28,046,746	34.0	953,216,197	29.1	277,047,537	[c] 29½	[c] 32¼	[c] 32⅛	[c] 34¾	48,434,541	40,025
1906	30,958,768	31.2	964,904,522	31.7	306,292,978	[c] 33	[c] 35¾	[c] 44½	[c] 48½	6,386,334	91,289
1907	31,837,000	23.7	754,443,000	44.3	334,568,000	[c] 46½	[c] 50⅞	[c] 52¾	[c] 56½	2,521,078	383,418
1908	32,344,000	25.0	807,156,000	47.2	381,171,000	[c] 48⅜	[c] 50½	[c] 56¼	[c] 62½	....	....

[a] In years 1866 to 1882, inclusive, oatmeal is not included.
[b] Census figures.
[c] Quotations are for standard.

Acreage, production, value, and distribution of oats in the United States in 1908.

State, Territory, or Division.	Crop of 1908. Acreage.	Crop of 1908. Production.	Crop of 1908. Farm value Dec. 1.	Stock in farmers' hands Mar. 1, 1909.		Shipped out of county where grown.	
	Acres.	*Bushels.*	*Dollars.*	*Bushels.*	*P. ct.*	*Bushels.*	*P. ct.*
Maine	119,000	4,046,000	2,428,000	1,012,000	25	162,000	4
New Hampshire	13,000	398,000	235,000	119,000	30	4,000	1
Vermont	80,000	2,664,000	1,652,000	1,039,000	39	27,000	1
Massachusetts	7,000	231,000	143,000	69,000	30	2,000	1
Rhode Island	2,000	62,000	40,000	19,000	30	0	0
Connecticut	11,000	359,000	208,000	90,000	25	0	0
New York	1,250,000	37,625,000	21,070,000	15,050,000	40	3,010,000	8
New Jersey	60,000	1,842,000	1,013,000	700,000	38	258,000	14
Pennsylvania	1,003,000	27,382,000	15,060,000	10,953,000	40	2,738,000	10
Delaware	4,000	119,000	64,000	37,000	31	13,000	11
Maryland	30,000	765,000	405,000	230,000	30	115,000	15
Virginia	200,000	3,820,000	2,101,000	1,184,000	31	306,000	8
West Virginia	95,000	1,805,000	1,011,000	596,000	33	54,000	3
North Carolina	200,000	3,300,000	2,079,000	891,000	27	99,000	3
South Carolina	201,000	4,020,000	3,015,000	764,000	19	161,000	4
Georgia	300,000	5,160,000	3,715,000	877,000	17	206,000	4
Florida	30,000	435,000	313,000	65,000	15	17,000	4
Ohio	1,460,000	38,544,000	18,887,000	13,490,000	35	11,563,000	30
Indiana	1,671,000	35,425,000	16,650,000	10,273,000	29	14,524,000	41
Illinois	4,100,000	94,300,000	44,321,000	30,176,000	32	47,150,000	50
Michigan	1,409,000	41,847,000	20,505,000	15,065,000	36	13,391,000	32
Wisconsin	2,350,000	73,085,000	34,350,000	31,427,000	43	14,617,000	20
Minnesota	2,682,000	59,004,000	25,372,000	21,241,000	36	17,701,000	30
Iowa	4,545,000	110,444,000	46,386,000	40,864,000	37	49,700,000	45
Missouri	700,000	13,510,000	6,080,000	4,323,000	32	1,891,000	14
North Dakota	1,399,000	32,737,000	13,750,000	14,732,000	45	4,583,000	14
South Dakota	1,365,000	31,395,000	12,872,000	11,616,000	37	8,791,000	28
Nebraska	2,549,000	56,078,000	22,992,000	21,310,000	38	19,067,000	34
Kansas	994,000	21,868,000	9,841,000	6,123,000	28	2,405,000	11
Kentucky	173,000	2,803,000	1,514,000	813,000	29	112,000	4
Tennessee	175,000	3,675,000	1,948,000	992,000	27	588,000	16
Alabama	235,000	4,230,000	2,792,000	931,000	22	127,000	3
Mississippi	125,000	2,188,000	1,466,000	438,000	20	44,000	2
Louisiana	30,000	600,000	384,000	90,000	15	6,000	1
Texas	750,000	21,675,000	11,271,000	3,468,000	16	4,768,000	22
Oklahoma	450,000	11,250,000	5,062,000	2,925,000	26	4,275,000	38
Arkansas	173,000	3,702,000	1,962,000	963,000	26	148,000	4
Montana	254,000	10,566,000	5,177,000	2,642,000	25	5,283,000	50
Wyoming	78,000	2,839,000	1,420,000	852,000	30	85,000	3
Colorado	178,000	7,031,000	3,797,000	2,250,000	32	2,109,000	30
New Mexico	24,000	804,000	515,000	145,000	18	121,000	15
Arizona	4,000	144,000	107,000	40,000	28	26,000	18
Utah	53,000	2,624,000	1,260,000	892,000	34	1,260,000	48
Nevada	7,000	315,000	205,000	47,000	15	110,000	35
Idaho	127,000	5,588,000	2,626,000	1,453,000	26	2,906,000	52
Washington	194,000	8,633,000	4,144,000	2,158,000	25	2,763,000	32
Oregon	285,000	9,519,000	4,474,000	2,475,000	26	3,808,000	40
California	200,000	6,700,000	4,489,000	938,000	14	3,350,000	50
United States	32,344,000	807,156,000	381,171,000	278,847,000	34.6	244,444,000	30.3
Division:[a]							
North Atlantic	2,545,000	74,609,000	41,849,000	29,051,000	38.9	6,201,000	8.3
South Atlantic	1,060,000	19,424,000	12,703,000	4,644,000	23.9	971,000	5.0
N. Central E. of Miss. R	10,990,000	283,201,000	134,713,000	100,431,000	35.5	101,245,000	35.8
N. Central W. of Miss. R	14,234,000	325,036,000	137,293,000	120,209,000	37.0	104,138,000	32.0
South Central	2,111,000	50,123,000	26,399,000	10,620,000	21.2	10,068,000	20.1
Far Western	1,404,000	54,763,000	28,214,000	13,892,000	25.4	21,821,000	39.8

[a] See note *a*, page 599.

Average yield per acre of oats in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	26.1	26.8	32.0	36.8	35.0	37.5	35.0	39.0	39.5	36.6	39.5	35.8	37.1	34.0
New Hampshire	32.5	34.9	32.1	33.5	35.0	32.6	29.5	35.0	31.1	33.2	32.8	34.5	32.5	30.6
Vermont	34.9	34.7	33.8	37.2	37.0	34.9	33.0	40.0	38.2	37.9	39.4	37.2	34.0	33.3
Massachusetts	30.5	31.0	30.9	33.1	33.0	36.8	31.0	32.2	31.7	34.0	32.0	34.0	35.0	33.0
Rhode Island	31.4	28.5	28.4	29.4	26.0	30.9	29.4	36.2	28.1	25.4	29.4	29.3	29.5	31.0
Connecticut	31.2	28.0	26.6	30.8	28.0	31.0	28.7	34.5	31.2	33.5	34.5	34.2	31.5	32.6
New York	32.2	30.5	26.2	31.4	31.0	27.9	21.6	40.0	34.0	34.1	34.2	32.3	30.7	30.1
New Jersey	28.3	29.0	26.0	27.0	24.0	29.6	16.0	32.2	25.4	32.5	32.0	26.6	29.5	30.7
Pennsylvania	30.6	30.2	25.7	29.8	33.0	31.1	18.9	36.5	28.6	33.9	34.0	27.4	29.6	27.3
Delaware	16.6	22.6	19.9	23.7	20.0	21.0	18.5	22.6	22.2	28.2	31.2	24.5	30.0	29.8
Maryland	19.9	20.7	19.9	23.8	23.0	24.0	18.8	26.7	20.6	29.7	27.7	25.4	27.5	25.5
Virginia	16.4	12.1	13.5	16.0	14.0	14.8	14.9	17.5	13.8	21.1	17.8	18.0	19.6	19.1
West Virginia	21.2	20.0	19.3	22.7	23.0	21.0	18.7	28.6	21.7	26.4	24.1	20.6	19.3	19.0
North Carolina	13.8	11.4	11.1	13.5	12.0	13.9	14.4	12.7	11.4	15.8	15.3	16.2	15.6	16.5
South Carolina	10.4	12.0	11.1	14.8	12.0	15.5	15.8	13.1	14.0	17.1	16.3	18.5	20.0	20.0
Georgia	12.0	11.2	11.6	13.6	9.0	15.0	14.8	11.1	13.6	14.8	15.1	15.5	16.7	17.2
Florida	13.9	11.5	11.2	12.2	9.0	11.3	13.1	13.6	13.2	12.9	12.0	14.0	13.7	14.5
Ohio	29.6	30.6	29.3	34.8	36.0	38.0	31.5	41.1	30.6	40.9	35.8	32.8	22.8	26.4
Indiana	25.2	26.7	26.4	31.0	32.0	32.7	28.6	35.4	24.4	33.1	35.3	28.2	20.2	21.2
Illinois	30.5	33.2	30.4	32.5	38.0	38.0	28.2	37.7	26.6	32.0	35.5	29.5	24.5	23.0
Michigan	32.2	33.0	28.9	32.7	34.0	36.7	29.0	39.9	30.5	32.5	35.6	30.7	20.8	29.7
Wisconsin	33.9	33.1	30.3	34.9	36.0	32.0	29.1	39.9	32.8	35.0	39.0	37.4	22.0	31.1
Minnesota	35.1	34.3	31.0	33.3	32.0	25.2	32.1	39.0	32.3	39.2	37.5	32.5	24.5	22.0
Iowa	35.8	33.0	31.4	31.0	33.0	34.0	29.8	30.7	24.0	32.0	35.0	33.8	24.2	24.3
Missouri	29.4	26.6	24.0	22.5	25.0	27.4	11.2	32.5	22.1	22.7	27.2	22.8	21.5	19.3
North Dakota	.....	.....	28.0	29.1	30.0	10.3	32.6	38.4	27.4	37.4	38.9	32.5	24.5	23.4
South Dakota	.....	.....	22.6	30.4	26.0	21.5	28.8	34.8	38.6	39.0	39.0	36.4	24.7	23.0
Nebraska	34.9	30.5	24.2	28.0	30.0	21.8	19.8	34.6	29.5	30.7	31.0	29.5	20.4	22.0
Kansas	32.8	30.6	24.5	23.9	29.0	31.6	18.6	33.5	26.2	17.8	27.1	23.6	15.0	22.0
Kentucky	21.4	19.7	18.9	21.1	18.0	21.3	19.7	22.2	20.1	24.0	25.5	21.5	17.6	16.2
Tennessee	17.5	16.0	14.8	17.0	14.0	16.6	17.5	17.3	18.5	21.1	20.2	21.5	20.8	21.0
Alabama	13.0	12.3	12.0	14.1	10.0	14.4	14.5	10.9	15.8	14.9	16.5	17.2	17.5	18.0
Mississippi	15.1	13.0	12.3	15.3	10.0	14.0	15.2	15.4	15.0	19.2	18.5	18.0	17.9	17.5
Louisiana	16.5	13.7	13.5	16.1	18.0	18.0	13.4	15.2	15.9	18.4	16.0	17.2	14.5	20.0
Texas	26.5	27.7	23.1	27.6	25.0	38.0	16.3	23.2	35.5	32.0	31.4	34.8	19.0	28.9
Oklahoma	.....	.....	.....	30.5	33.0	38.0	22.7	41.7	27.9	26.0	34.2	34.3	15.0	25.0
Arkansas	21.7	18.9	17.9	19.1	19.0	22.2	12.3	20.0	18.6	22.7	20.3	20.5	19.5	21.4
Montana	.....	35.9	32.7	41.0	38.0	39.0	42.0	41.9	46.4	37.7	41.3	43.2	49.0	41.6
Wyoming	.....	29.7	30.4	33.9	30.0	34.2	41.0	36.0	29.4	30.2	39.9	39.5	37.0	36.4
Colorado	.....	30.7	28.5	32.2	27.0	32.8	33.8	26.8	33.3	35.4	35.0	40.4	38.0	39.5
New Mexico	.....	18.5	27.5	27.8	24.0	30.1	31.6	19.1	22.6	19.6	29.5	34.6	38.5	33.5
Arizona	.....	25.0	.....	32.7	21.5	30.0	35.0	31.7	35.5	30.1	31.2	34.4	29.0	36.0
Utah	.....	25.1	28.6	36.5	34.0	35.9	33.0	35.5	36.4	37.6	39.8	43.7	45.0	49.5
Nevada	34.4	31.0	27.4	36.1	35.0	35.0	43.0	34.8	28.6	37.0	37.2	38.8	43.0	45.0
Idaho	.....	33.5	31.4	39.3	34.0	36.6	38.3	42.1	41.5	39.3	39.4	40.7	50.5	44.0
Washington	.....	38.3	35.8	43.4	37.0	34.4	47.5	46.2	47.9	44.9	50.0	43.2	55.5	44.5
Oregon	35.0	31.7	27.6	27.0	30.0	18.5	31.5	28.7	33.8	23.1	24.1	33.8	35.0	33.4
California	33.8	27.9	28.0	29.5	31.0	24.6	30.4	30.5	34.8	34.1	28.0	31.5	33.5	33.5
United States	28.1	27.6	25.6	29.6	30.2	29.6	25.8	34.5	28.4	32.1	34.0	31.2	23.7	25.0
Division:[a]														
North Atlantic	31.2	30.4	26.5	31.0	32.0	29.9	21.2	38.2	31.8	34.2	34.4	30.4	30.7	29.3
South Atlantic	16.5	12.6	12.9	15.4	12.9	15.6	15.3	15.2	14.2	18.2	17.1	17.6	18.1	18.3
N. Central E. of Miss. R.	30.6	31.9	29.6	33.2	36.1	35.7	28.9	38.5	28.8	34.1	36.4	31.7	22.6	25.8
N. Central W. of Miss. R.	33.4	31.1	27.7	29.6	30.7	27.8	26.2	34.0	27.9	32.2	34.4	31.5	22.8	22.8
South Central	19.7	17.6	17.4	23.2	18.0	24.5	17.1	24.3	26.7	26.1	27.7	29.3	17.8	23.7
Far Western	34.4	31.4	29.5	33.7	31.9	28.9	36.3	34.6	38.1	33.9	35.1	38.5	43.0	39.0

[a] See note *a*, page 599.

Average farm value per acre of oats in the United States December 1.

State, Territory, or Division.	10-year averages.				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	14.09	12.06	13.76	14.72	13.30	14.25	17.50	17.55	17.77	16.47	16.55	15.75	22.26	20.40
N. Hampshire	17.55	16.05	14.12	14.07	13.65	12.39	15.34	15.40	14.93	15.60	14.10	15.18	19.85	18.08
Vermont	17.10	14.57	13.86	14.51	13.69	12.56	16.50	17.20	16.81	16.68	15.76	16.00	21.42	20.65
Massachusetts	18.00	15.50	13.60	13.90	12.54	13.98	17.05	14.49	15.53	15.30	13.76	14.96	21.00	20.43
Rhode Island	17.27	14.25	12.78	12.05	9.62	11.74	15.88	15.57	12.65	11.94	12.35	13.19	19.50	20.00
Connecticut	18.10	13.44	11.17	12.32	10.36	10.85	15.50	14.14	14.04	14.74	14.49	14.36	18.90	18.91
New York	14.81	11.90	9.43	10.99	10.23	8.93	10.37	14.40	13.94	12.96	12.65	12.92	17.56	16.86
New Jersey	13.30	11.31	9.88	9.72	7.92	9.18	7.52	12.56	10.92	13.00	11.84	10.11	16.52	16.88
Pennsylvania	12.85	11.17	9.25	9.83	9.57	9.33	8.50	12.41	10.58	12.88	12.24	10.41	15.98	15.01
Delaware	6.97	8.36	7.16	8.06	5.00	6.30	8.33	9.49	8.88	11.56	12.48	9.31	15.00	16.00
Maryland	8.36	7.66	6.96	7.85	6.90	7.44	7.71	10.15	8.24	10.69	9.97	9.65	13.47	13.50
Virginia	6.56	4.96	5.00	5.76	4.62	5.48	6.26	7.35	5.93	9.07	6.94	7.74	9.80	10.50
W. Virginia	7.21	7.20	7.14	8.40	8.05	7.14	8.04	11.73	9.98	11.62	9.10	8.24	10.42	10.64
N. Carolina	7.45	5.59	5.00	6.08	4.92	6.26	7.34	6.48	5.93	8.22	7.19	7.94	9.36	10.40
S. Carolina	7.59	7.80	6.10	7.84	5.64	7.44	9.80	7.73	8.26	10.26	8.96	10.54	14.40	15.00
Georgia	8.64	6.94	6.26	7.07	4.32	7.35	9.92	5.88	7.48	8.14	8.00	8.68	12.02	12.38
Florida	12.51	9.32	6.72	6.47	4.50	5.65	9.43	8.30	7.92	7.74	6.24	9.52	10.27	10.43
Ohio	10.06	9.79	8.79	9.74	9.00	9.88	12.28	13.15	11.02	13.09	11.10	10.82	10.26	12.94
Indiana	7.81	7.74	7.66	8.06	7.36	7.52	10.87	9.91	7.81	9.93	9.53	9.02	8.48	9.96
Illinois	8.54	8.96	8.21	8.45	8.36	8.74	11.28	10.56	8.51	9.60	9.94	9.11	10.05	10.81
Michigan	11.91	11.22	9.25	9.81	9.52	9.54	11.89	13.17	10.98	10.72	10.68	10.13	9.98	14.55
Wisconsin	11.53	9.60	8.48	9.07	8.28	7.36	11.35	11.97	11.15	9.80	10.53	11.59	10.34	14.62
Minnesota	11.93	9.60	8.06	7.99	7.04	6.05	10.91	10.53	9.69	10.19	9.00	8.77	10.05	9.46
Iowa	8.95	7.59	7.54	7.13	6.27	6.80	10.73	7.67	6.96	8.00	8.40	9.13	9.20	10.21
Missouri	8.82	7.18	6.24	6.08	6.00	6.30	4.82	9.10	7.07	7.72	8.16	7.52	8.81	8.69
N. Dakota	......	......	7.00	7.86	8.10	3.30	10.76	10.37	8.49	8.98	8.95	8.78	9.80	9.83
S. Dakota	......	......	5.65	7.30	5.98	5.16	9.79	10.09	11.19	9.75	8.97	9.10	9.63	9.43
Nebraska	10.12	6.71	5.57	6.44	6.60	5.23	7.33	8.65	7.97	7.67	7.44	7.67	7.55	9.02
Kansas	10.17	7.65	6.37	6.21	6.38	7.27	8.00	10.05	7.86	5.87	7.59	7.32	6.30	9.90
Kentucky	8.35	7.09	6.43	6.96	5.76	6.60	8.08	7.99	8.24	9.60	8.58	8.17	8.62	8.75
Tennessee	7.35	6.24	5.18	5.95	4.48	5.81	7.87	7.27	7.77	7.80	7.88	8.82	10.40	11.13
Alabama	9.36	7.63	6.36	6.91	4.30	6.34	9.28	6.00	8.53	8.05	8.42	8.77	11.72	11.88
Mississippi	12.38	8.32	6.40	7.50	5.00	6.44	9.58	7.85	7.65	9.98	9.25	8.82	11.63	11.73
Louisiana	16.17	8.63	6.48	7.08	7.20	7.20	8.04	7.60	7.31	8.28	7.20	7.74	7.96	12.80
Texas	18.82	13.57	9.24	10.76	7.50	11.40	9.78	11.37	15.62	14.08	12.56	14.27	11.40	15.03
Oklahoma	......	......	......	11.28	6.93	8.74	10.86	14.57	9.60	9.63	10.51	10.14	7.20	11.25
Arkansas	13.02	9.26	7.34	7.45	6.46	7.77	7.01	8.20	8.18	9.76	8.53	8.61	10.53	11.34
Montana	......	18.67	14.39	15.58	14.82	16.38	15.12	15.08	16.24	17.34	17.76	19.01	22.54	20.38
Wyoming	......	14.26	13.07	14.92	12.00	16.07	19.68	18.00	14.70	11.78	16.36	15.80	19.42	18.21
Colorado	......	18.42	11.40	13.52	11.34	14.10	16.90	13.67	13.65	16.28	14.35	18.18	19.00	21.33
New Mexico	......	10.73	13.20	14.46	10.56	14.45	18.96	12.99	14.01	11.17	17.11	17.99	21.17	21.46
Arizona	......	15.50	......	21.91	14.62	20.70	21.00	23.78	21.65	22.27	19.97	22.36	17.50	26.75
Utah	......	11.80	11.44	15.70	13.60	15.80	16.83	16.68	17.84	17.67	17.51	19.66	21.60	23.77
Nevada	31.99	20.46	14.80	23.46	20.65	17.50	30.10	24.36	19.45	23.31	19.34	24.83	31.00	29.29
Idaho	......	18.09	13.50	15.72	12.92	14.64	16.85	20.21	18.68	19.65	16.55	17.50	21.21	20.68
Washington	......	16.47	13.60	17.36	14.06	13.76	16.63	22.64	18.20	19.31	20.50	17.71	21.97	21.36
Oregon	18.55	13.95	10.49	10.80	12.30	7.59	10.71	11.77	14.87	10.86	10.36	14.53	15.75	15.70
California	23.66	17.02	13.44	14.46	14.57	11.32	13.38	15.55	18.79	19.44	14.28	16.38	23.79	22.44
United States	10.62	9.03	7.63	8.32	7.52	7.63	10.29	10.60	9.68	10.05	9.88	9.89	10.51	11.78
Division:[a]														
N. Atlantic	14.07	11.80	9.73	10.73	10.21	9.51	9.99	13.70	12.68	13.21	12.73	12.00	17.25	16.44
S. Atlantic	7.69	6.39	5.73	6.79	5.12	6.69	8.36	7.37	7.26	9.15	7.97	8.76	11.49	11.97
N. C. E. of Miss. R	9.67	9.35	8.41	8.83	8.41	8.47	11.41	11.36	9.64	10.25	10.24	10.04	9.88	12.28
N. C. W. of Miss. R	9.65	7.74	6.87	7.07	6.52	6.16	9.42	9.01	8.15	8.36	8.37	8.53	8.91	9.62
S. Central	9.02	8.34	6.84	8.93	5.94	8.12	9.19	10.28	11.27	11.10	10.53	11.20	9.95	12.49
Far Western	21.12	15.42	11.95	14.15	13.00	12.20	14.60	15.77	16.43	16.16	15.23	17.06	20.81	20.08

[a] See note *a*, page 599.

Average farm price of oats per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan. 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Maine	54	45	43	40	38	38	50	45	45	45	43	44	60	60	61	62	64	70	66	60
New Hampshire	54	46	44	42	39	38	52	44	48	47	43	44	61	59	62	61	65	65	68	62
Vermont	49	42	41	39	37	36	50	43	44	44	40	43	63	62	62	62	65	66	65	61
Massachusetts	59	50	44	42	38	38	55	45	49	45	43	44	60	62	61	68	65	63	69	62
Rhode Island	55	50	45	41	37	38	54	43	45	47	42	45	66	64	64	52	65	69	70	65
Connecticut	58	48	42	40	37	35	54	41	45	44	42	42	60	58	62	63	63	66	65	60
New York	46	39	36	35	33	32	48	36	41	38	37	40	57	56	55	57	64	61	57	53
New Jersey	47	39	38	36	33	31	47	39	43	40	37	38	56	55	55	55	60	60	57	56
Pennsylvania	42	37	36	33	29	30	45	34	37	38	36	38	54	55	54	55	60	61	57	56
Delaware	42	37	36	34	25	30	45	42	40	41	40	38	50	54	52	54	60	57	55	53
Maryland	42	37	35	33	30	31	41	38	40	36	36	38	49	53	49	51	58	57	55	53
Virginia	40	41	37	36	33	37	42	42	43	43	39	43	50	55	52	57	56	58	57	54
West Virginia	34	36	37	37	35	34	43	41	46	44	39	40	54	56	54	57	65	65	58	58
North Carolina	54	49	45	45	41	45	51	51	52	52	47	49	60	63	60	64	67	65	63	63
South Carolina	73	65	55	53	47	48	62	59	59	60	55	57	72	75	73	76	74	75	75	73
Georgia	72	62	54	52	48	49	67	53	55	55	53	56	72	72	69	72	66	73	69	72
Florida	90	81	60	53	50	50	72	61	60	60	52	68	75	72	75	76	70	72	80	72
Ohio	34	32	30	28	25	26	39	32	36	32	31	33	45	49	48	51	53	53	50	48
Indiana	31	29	29	26	23	23	38	28	32	30	27	32	42	47	43	46	50	49	47	47
Illinois	28	27	27	26	22	23	40	28	32	30	28	31	41	47	45	45	49	48	46	46
Michigan	37	34	32	30	28	26	41	33	36	33	30	33	48	49	51	52	54	57	48	49
Wisconsin	34	29	28	26	23	23	39	30	34	28	27	31	47	47	47	49	51	52	47	47
Minnesota	34	28	26	24	22	24	34	27	30	26	24	27	41	43	43	45	46	47	42	43
Iowa	25	23	24	23	19	20	36	25	29	25	24	27	38	42	41	43	45	43	43	42
Missouri	30	27	26	27	24	23	43	28	32	34	30	33	41	45	40	45	48	48	46	45
North Dakota	......	......	29	27	27	32	33	27	31	24	23	27	40	42	45	44	46	48	43	41
South Dakota	......	......	25	24	23	24	34	29	29	25	23	25	39	41	42	43	45	46	42	41
Nebraska	29	22	23	23	22	24	37	25	27	25	24	26	37	41	41	41	44	44	41	40
Kansas	31	25	26	26	22	23	43	30	30	33	28	31	42	45	45	49	49	50	47	45
Kentucky	39	36	34	33	32	31	41	36	41	40	35	38	49	54	49	55	59	59	57	55

Average farm price of oats per bushel in the United States—Continued.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan. 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Tennessee	42	39	35	35	32	35	45	42	42	37	39	41	50	53	50	58	64	58	54	52
Alabama	72	62	53	49	43	44	64	55	54	54	51	51	67	66	65	72	72	71	68	69
Mississippi	82	64	52	49	50	46	63	51	51	52	50	49	65	67	65	69	70	74	67	68
Louisiana	98	63	48	44	40	40	60	50	46	45	45	45	55	64	65	73	70	71	61	60
Texas	71	49	40	39	30	30	60	49	44	44	40	41	60	52	55	63	60	50	50	51
Oklahoma	......	......	......	37	21	23	48	35	34	37	31	30	48	45	47	56	54	50	45	44
Arkansas	60	49	41	39	34	35	57	41	44	43	42	42	54	53	55	64	66	58	56	52
Montana	......	52	44	38	39	42	36	36	35	46	43	44	46	49	44	43	47	52	51	53
Wyoming	......	48	43	44	40	47	48	50	50	39	41	40	53	50	55	54	54	57	64	55
Colorado	......	60	40	42	42	43	50	51	41	46	41	45	50	54	44	48	53	53	57	57
New Mexico	......	58	48	52	44	48	60	68	62	57	58	52	55	64	64	57	66	67	55	56
Arizona	......	62	......	67	68	69	60	75	61	74	64	65	60	74	71	81	80	75	99	71
Utah	......	47	40	43	40	44	51	47	49	47	44	45	48	48	50	45	52	54	55	47
Nevada	93	66	54	65	59	50	70	70	68	63	52	64	72	65	77	66	67	94	83	61
Idaho	......	54	43	40	38	40	44	48	45	50	42	43	42	47	40	46	42	47	44	45
Washington	......	43	38	40	38	40	35	49	38	43	41	41	45	48	41	48	48	46	45	46
Oregon	53	44	38	40	41	41	34	41	44	47	43	43	45	47	44	47	44	45	45	46
California	70	61	48	49	47	46	44	51	54	57	51	52	71	67	66	66	69	65	62	63
United States	37.8	32.7	29.8	28.1	24.9	25.8	39.9	30.7	34.1	31.3	29.1	31.7	44.3	47.2	46.1	47.9	50.4	50.2	47.2	46.5
Divisions[a]:																				
North Atlantic	45.1	38.8	36.7	34.6	31.9	31.8	47.1	35.9	39.9	38.6	37.0	39.5	56.2	56.1	55.3	56.6	62.4	61.5	57.8	55.0
South Atlantic	46.6	50.7	44.4	44.1	39.6	42.7	54.5	48.5	51.1	50.2	46.7	49.8	63.5	65.4	63.2	66.2	65.9	68.3	65.9	65.8
North Central East of Mississippi River	31.6	29.3	28.4	26.6	23.3	23.7	39.5	29.5	33.5	30.1	28.1	31.7	43.7	47.6	46.3	47.6	50.7	50.9	47.2	47.0
North Central West of Mississippi River	28.9	24.9	24.8	23.9	21.3	22.2	36.0	26.5	29.2	25.9	24.4	27.1	39.1	42.2	42.6	43.6	45.5	45.5	42.8	42.0
South Central	45.8	47.4	39.3	38.5	33.0	33.1	53.8	42.3	42.3	42.5	38.0	38.3	55.9	52.7	54.1	62.0	61.8	56.6	53.7	53.2
Far Western	61.4	49.1	40.5	42.0	40.8	42.2	40.3	45.6	43.1	47.6	43.3	44.3	48.4	51.5	46.0	48.3	49.5	51.3	51.2	51.2

[a] See note *a*, page 599.

Wholesale prices of oats per bushel, 1895–1908.

Date.	New York.		Baltimore.		Cincinnati.		Chicago.		Milwaukee.		Duluth.		Detroit.		San Francisco.	
	No. 2, mixed.		No. 2, mixed.		No. 2, mixed.		No. 2.		No. 2, white.		No. 2.		No. 2, white.		No. 1, white (per cwt.).	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		
1895....	22½	34¾	22	36	19	34½	16⅝	30⅞	18	34	15½	32½	20½	35	$0.67½	$1.00
1896....	18¾	26	20	27	15½	23	14¾	20¼	16½	22¼	15¼	20¾	18½	24¼	.72½	1.15
1897....	21	29¼	21	28	16¾	25	15⅝	23⅞	16½	26	16¼	25½	19¼	26	1.12½	1.30
1898....	25½	36	24	36	21½	34½	20¼	32	22¾	34½	20	33¼	23¼	36¼	1.15	1.42½
1899....	25¾	35½	24½	35	21½	31½	19¼	28¼	22¾	31½	19½	30½	23½	33	1.22½	1.45
1900....	24¾	29¾	24	29½	21	28	21	26¼	24	29	22½	28	24	29¼	1.22½	1.40
1901....	28¼	52	28	53	25	50¾	23¼	48¼	25½	48¾	25¼	46⅞	28	60½	1.02½	1.55
1902....	32	65	29	60	27	57	25	56	30½	58	27½	47⅛	34¾	61	1.15	1.50
1903....	38	44½	34½	44	31½	43½	31¼	45	33½	41	31	40	35½	45	1.17½	1.37½
1904....	34½	55½	33	48	31	44½	28¼	46	28½	45	27¾	43	31¾	48¼	1.25	1.60
1905.							Standard				(a)					
Jan....	35½	37½	36¼	37	32¾	33½	29⅜	31	31½	32½	28¾	29¾	33½	34½	1.45	1.60
Feb....	36	37	35	36½	32¾	33½	29½	32¼	32	33	28⅝	30¼	33¼	34¼	1.45	1.60
Mar....	35¾	37½	35	36¾	31¾	34½	29¼	33¼	32	34½	28½	31¼	33½	34¼	1.45	1.60
Apr....	34¼	36	33½	35½	30½	32½	28⅜	33	32	33½	28½	29¾	33	34¼	1.45	1.60
May....	34½	35½	33½	34½	30½	32¾	28⅝	32	31¾	34	28⅝	31⅜	33	34¾	1.45	1.67½
June...	34½	36	33¾	36½	32½	33½	30¼	33¼	33	34¼	30⅜	32½	33¾	34½	1.65	1.80
July ...	33½	36½	33	36½	28	34	27	34¼	33	35½	27½	32¾	35	37	......	......
Aug....	29	33	27½	32½	25	32	25¼	29½	27⅛	34	25½	28⅝	27	35½	......	......
Sept...	29	33½	28	32½	26	30	25	30	28	30	25¼	28⅛	26¼	30½	1.37½	1.47½
Oct....	32½	35¾	32	35	29	32	27½	30¾	29	32	26⅞	29⅞	29¾	32¾	1.37½	1.45
Nov....	34½	36	34	34¾	31½	33½	29	31⅜	31	32	28⅜	30	32¼	33	1.37½	1.50
Dec....	36	37	34	36½	33	35½	29½	32¾	31½	33½	29	30⅛	32¾	35	1.45	1.55
1906.									No.3, white							
Jan....	36	37½	34½	37	32½	34	29½	32	30	32	29	30	33	35	......	......
Feb....	34	36	34	35½	32	33½	29⅜	30¾	29	31½	28½	29½	32½	33¾	......	......
Mar....	34½	36½	34¼	35¾	32	33½	28⅞	30¾	29	32¼	28⅛	29¾	32	34	......	......
Apr....	36¼	37	35½	38	33	35	30⅞	32¾	30½	33¾	29⅞	31½	33¼	35	......	......
May....	37	39	37½	39	33	37	32⅛	34¾	32	35½	31⅛	34½	35¼	37¾	......	......
June...	39	45	38½	45½	37	43	33¾	42¾	33¾	43	33¾	41	37¼	43¼	......	......
July....	40	43½	38½	42½	34	41	30¼	39¼	33	40	31¾	38	38	42	......	......
Aug....	34½	39	33½	39½	30	34	29⅛	32	29	35½	30	31	32	39	......	......
Sept...	34½	37½	34	37	31½	36	30	34¼	29	34	29¼	33	33	36½	......	......
Oct....	37½	38½	37	37¾	35	36½	32¼	34¾	32	34½	31¼	33	36	36½	......	......
Nov....	37½	39½	37	38½	35	36½	33	35¼	32	34¾	32	32⅝	36½	38½	......	......
Dec....	38	39	38	39½	36	38	33	35¾	32½	35½	31⅞	34	35	37	......	......
1907.											No. 3		No.3, white			
Jan....	38½	42	39½	42	37	40	33½	37¼	32¾	38	33½	37	37	41½	1.42½	1.65
Feb....	41½	47½	41½	47	39½	45	37	41¼	37¼	42	37	39	42½	44¾	1.45	1.67½
Mar....	46½	48½	47	49	44	45½	39⅝	43	39¾	43	38	41	41	45½	1.45	1.70
Apr....	45½	47½	46½	49½	43	44½	41½	45½	40	43	39	42	42½	47½	$1.50	$1.75
May....	46½	50	45½	48	43½	47	44½	48½	42	48	41	44	46	49½	1.55	1.75
June...	48½	50½	46½	49½	46	50	41⅜	49⅜	41½	48	40½	44½	46½	50	1.40	1.70
July....	48½	49½	47	50½	45½	47½	41⅛	46	41¼	46½	40	42	47¼	50	1.30	1.60
Aug....	50½	63	50½	59½	45	53	44⅞	54	45	54½	41	48	49	56	1.42½	1.55
Sept...	51	53	52	54½	49	52	51	56½	47	56	48	51	52	56	1.45	1.60
Oct....	50½	55½	53	57	44½	55½	45	54¾	39	54½	46	53	50	58	1.50	1.80
Nov....	51	52½	50	53½	45	49	44½	49	45	50¼	45	48	52	53	1.60	1.85
Dec....	51½	54½	50	54½	48	53	46½	50⅞	46½	53	46	49	52	54¼	1.55	1.70
1908.																
Jan....	53	53½	53	54½	51½	52½	48¼	51½	49	52¼	46½	49	53¼	54	1.55	1.70
Feb....	53	57½	52½	56½	50½	53	48¼	53⅜	47½	53	47	50	53	55½	1.55	1.70
Mar....	55	57	56	57½	52½	54	52⅛	54⅝	50½	54½	49½	51	54¾	56	1.45	1.65
Apr....	54	54½	55½	56½	51	53	51¾	53⅞	50	53¼	47	49½	55	57	1.50	1.65
May....	53½	57	56	57	50½	54½	52¾	56½	51½	56	49	51	55	56	1.47½	1.62½
June...	52½	56	55½	57½	52	54½	50	53	48	54½	48½	50½	55	56	1.40	1.57½
July....	53½	61½	57	62	50	60	51	60½	47½	62½	49	57	55	64	1.40	1.55
Aug....	50½	59½	50½	62	48	51½	46	50	45	47	46⅜	56	47	62	1.45	1.60
Sept...	52	53	51	52	50	53	48	50¼	46	51¼	46¾	49½	49	53	1.60	1.67½
Oct....	51	53	50½	51½	47	51½	46¾	49	45½	52	45¾	47¾	50½	52½	1.60	1.68¾
Nov....	51½	55	51	54	48	52½	47⅝	49½	47	53	46	48½	51½	53	1.65	1.75
Dec....	52½	56	53	55	50½	52½	48⅜	50½	48¼	52½	47½	50	51	54	1.70	1.75

[a] No grade of oats in Duluth for 1905.

BARLEY.

Barley crop of countries named, 1904–1908.

Country.	1904.	1905.	1906.	1907.	1908.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	139,749,000	136,651,000	178,916,000	153,597,000	166,756,000
Canada:					
New Brunswick	96,000	100,000	102,000	152,000	81,000
Ontario	25,342,000	25,030,000	26,049,000	22,403,000	21,790,000
Manitoba	11,530,000	14,507,000	18,085,000	17,281,000	17,632,000
Saskatchewan	617,000	922,000	1,358,000	1,393,000	2,014,000
Alberta	1,659,000	1,830,000	2,226,000	1,058,000	4,003,000
Other	3,000,000	3,000,000	3,000,000	3,446,000	2,716,000
Total Canada	42,244,000	45,389,000	50,820,000	45,733,000	48,236,000
Mexico	7,355,000	6,621,000	7,000,000	7,000,000	7,000,000
Total North America	189,348,000	188,661,000	236,736,000	206,330,000	221,992,000
EUROPE.					
Austria-Hungary:					
Austria	66,815,000	70,469,000	76,024,000	78,555,000	69,426,000
Hungary proper	49,915,000	62,453,000	69,747,000	63,078,000	56,324,000
Croatia-Slavonia	2,285,000	2,864,000	2,758,000	2,719,000	2,526,000
Bosnia-Herzegovina	3,496,000	3,236,000	3,276,000	2,388,000	2,389,000
Total Austria-Hungary	122,511,000	139,022,000	151,805,000	146,740,000	130,665,000
Belgium	5,003,000	4,518,000	4,349,000	5,129,000	4,500,000
Bulgaria	12,911,000	11,431,000	12,008,000	6,772,000	8,500,000
Denmark	21,479,000	19,596,000	19,975,000	21,616,000	20,000,000
Finland	4,916,000	5,318,000	5,000,000	5,000,000	6,000,000
France	38,338,000	40,841,000	36,538,000	43,043,000	40,585,000
Germany	135,409,000	134,204,000	142,901,000	160,650,000	140,539,000
Italy	7,000,000	8,000,000	8,000,000	8,000,000	8,000,000
Netherlands	3,606,000	4,013,000	3,260,000	4,091,000	4,500,000
Norway	2,496,000	3,464,000	3,262,000	2,597,000	3,028,000
Roumania	11,567,000	26,383,000	33,539,000	20,062,000	12,873,000
Russia:					
Russia proper	290,766,000	272,694,000	243,619,000	277,500,000	297,454,000
Poland	17,705,000	22,732,000	23,351,000	25,395,000	23,790,000
Northern Caucasia	31,246,000	43,410,000	37,306,000	41,206,000	46,220,000
Total Russia (European)	339,717,000	338,836,000	304,276,000	344,101,000	367,464,000
Servia	3,162,000	3,670,000	4,848,000	3,137,000	4,000,000
Spain	53,800,000	45,917,000	91,185,000	53,598,000	69,596,000
Sweden	13,452,000	12,858,000	14,328,000	13,553,000	15,520,000
United Kingdom:					
Great Britain—					
England	48,511,000	48,778,000	51,543,000	51,926,000	46,353,000
Scotland	7,408,000	8,257,000	7,803,000	7,466,000	7,410,000
Wales	3,077,000	2,906,000	3,116,000	2,881,000	2,682,000
Ireland	5,478,000	7,181,000	7,211,000	6,934,000	7,134,000
Total United Kingdom	64,474,000	67,122,000	69,673,000	69,207,000	63,579,000
Total Europe	839,841,000	865,193,000	904,947,000	907,296,000	899,349,000
ASIA.					
Cyprus	3,122,000	2,980,000	2,778,000	2,963,000	3,100,000
Japanese Empire:					
Japan	80,794,000	77,473,000	83,968,000	90,544,000	87,915,000
Formosa	58,000	50,000	49,000	50,000	50,000
Total Japanese Empire	80,852,000	77,523,000	84,017,000	90,594,000	87,965,000
Russia:					
Central Asia	2,262,000	3,145,000	2,614,000	4,957,000	4,345,000
Siberia	4,268,000	4,965,000	5,136,000	4,385,000	6,103,000
Transcaucasia[a]	8,000	20,000	13,000	4,000	13,000
Total Russia (Asiatic)	6,538,000	8,130,000	7,763,000	9,346,000	10,461,000
Total Asia	90,512,000	88,633,000	94,558,000	102,903,000	101,526,000

[a] Includes Chernomorsk only.

Barley crop of countries named, 1904-1908—Continued.

Country.	1904.	1905.	1906.	1907.	1908.
AFRICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Algeria	36,125,000	27,330,000	47,600,000	41,543,000	35,000,000
Cape of Good Hope	949,000	900,000	900,000	900,000	900,000
Natal	6,000	7,000	5,000	5,000	5,000
Sudan (Anglo-Egyptian)	251,000	327,000	334,000	300,000	300,000
Tunis	14,815,000	7,119,000	7,863,000	9,506,000	4,257,000
Total Africa	52,146,000	35,683,000	56,702,000	52,254,000	40,462,000
AUSTRALASIA.					
Australia:					
Queensland	527,000	342,000	64,000	163,000	67,000
New South Wales	180,000	275,000	115,000	158,000	78,000
Victoria	1,256,000	902,000	1,096,000	1,295,000	1,093,000
South Australia	503,000	358,000	522,000	507,000	585,000
Western Australia	55,000	39,000	51,000	50,000	78,000
Tasmania	219,000	168,000	97,000	146,000	154,000
Total Australia	2,740,000	2,084,000	1,945,000	2,319,000	2,055,000
New Zealand	1,197,000	1,164,000	1,056,000	1,068,000	1,200,000
Total Australasia	3,937,000	3,248,000	3,001,000	3,387,000	3,255,000
Grand total	1,175,784,000	1,181,418,000	1,295,944,000	1,272,170,000	1,266,584,000

Average yield of barley in countries named, bushels per acre, 1888-1907

Year.	United States.[a]	Russia, European.[b]	Germany.[b]	Austria.[b]	Hungary proper.[b]	France.[a]	United Kingdom.[a]
Average (1888 to 1897)	23.2	12.6	27.6	20.2	20.3	21.5	34.4
1898	21.6	14.9	32.2	22.0	23.6	23.3	37.4
1899	25.5	10.9	33.8	24.9	24.0	22.7	35.8
1900	20.4	11.5	23.4	20.2	20.9	21.8	32.7
1901	25.6	11.2	33.2	22.4	20.0	21.1	32.7
1902	29.0	15.6	35.0	24.6	24.7	24.5	37.0
1903	26.4	15.5	36.3	24.8	25.1	25.2	33.4
1904	27.2	14.4	33.7	22.8	19.8	22.0	32.3
1905	26.8	14.3	33.2	24.0	24.5	23.4	35.9
1906	28.3	14.1	35.2	26.1	26.8	20.8	36.2
1907	23.8	14.2	38.2	27.3	29.7	24.4	36.8
Average (1898 to 1907)	25.5	13.7	34.4	23.9	23.8	22.9	34.9

[a] Winchester bushels. [b] Bushels of 48 pounds.

Condition of the barley crop in the United States on the first of months named, 1888–1908.

Year.	June.	July.	August.	When harvested.	Year.	June.	July.	August.	When harvested.
	P. ct.	P. ct.	P. ct.	P. ct.		P. ct.	P. ct.	P. ct.	P. ct.
1888	88.8	91.0	89.4	86.9	1899	91.4	92.0	93.6	86.7
1889	95 6	91.9	90.6	88.9	1900	86.2	76.3	71.6	70.7
1890	86.4	88.3	82.8	78.6	1901	98 8	91.3	86.9	85.8
1891	90.3	90.9	93.8	94.3	1902	93.6	93.7	90.2	89.7
1892	92.1	92.0	91.1	87.4	1903	91.5	86.8	83.4	82.1
1893	88.3	88.8	84.6	83.8	1904	90.5	88.5	88.1	87.4
1894	82.2	76.8	69.8	71.5	1905	93.7	91.5	89.5	87.8
1895	90.3	91.9	87.2	87.6	1906	93 5	92.5	90 3	89.4
1896	98 0	88.1	82.9	83.1	1907	84.9	84.4	84 5	78.5
1897	87.4	88.5	87.5	86.4	1908	89.7	86.2	83.1	81.2
1898	78.8	85.7	79.3	79.2					

Acreage, production, value, prices, exports, etc., of barley in the United States, 1849–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, fiscal year beginning July 1.	Imports, fiscal year beginning July 1.
	Acres.	Bush.	Bushels.	Cts.	Dollars.	Cts.	Cts.	Cts.	Cts.	Bushels.	Bushels.
1849 [a]			5,167,015								
1859 [a]			15,825,898								
1866	492,532	22.9	11,283,807	70.2	7,916,342	59	70	85	100		3,247,250
1867	1,131,217	22.7	25,727,000	70.1	18,027,746	150	180	227	250	9,810	3,783,966
1868	937,498	24.4	22,896,100	109.0	24,948,127	140	170	149	175	59,077	5,069,880
1869	1,025,795	27.9	28,652,200	70.8	20,298,164	74	85	50	62	255,490	6,727,597
1870	1,108,924	23.7	26,295,400	79.1	20,792,213	68	80	72	95	340,093	4,866,700
1871	1,113,735	24.0	26,718,500	75.8	20,264,015	55½	64	55	71	86,891	5,565,591
1872	1,397,082	19.2	26,846,400	68.6	18,415,839	60	70	71	85	482,410	4,244,751
1873	1,387,106	23.1	32,044,491	86.7	27,794,229	132	158	130	155	320,399	4,891,189
1874	1,580,626	20.6	32,552,500	86.0	27,997,824	120	129½	115	137	91,118	6,255,063
1875	1,789,902	20.6	36,908,600	74.1	27,367,522	81	88	62½	72½	317,781	10,285,957
1876	1,766,511	21.9	38,710,500	63.0	24,402,691	63¾	68½	80	85	1,186,129	6,702,965
1877	1,614,654	21.3	34,441,400	62.8	21,629,130	56¼	64	46½	52½	3,921,501	6,764,228
1878	1,790,400	23.6	42,245,630	57.9	24,454,301	91	100	64	73	715,536	5,720,979
1879	1,680,700	24.0	40,283,100	58.9	23,714,444	86	92	75	80	1,128,923	7,135,258
1880	1,843,329	24.5	45,165,346	66.6	30,090,742	100	120	95	105	885,246	9,528,616
1881	1,967,510	20.9	41,161,330	82.3	33,862,513	101	107	100	100	205,930	12,182,722
1882	2,272,103	21.5	48,953,926	62.9	30,768,015	79	82	80	80	433,005	10,050,687
1883	2,379,009	21.1	50,136,097	58.7	29,420,423	62	67	65	74	724,955	8,596,122
1884	2,608,818	23.5	61,203,000	48.7	29,779,170	53	58	65	65	629,130	9,986,507
1885	2,729,359	21.4	58,360,000	56.3	32,867,696	62	65	58	60	252,183	10,197,115
1886	2,652,957	22.4	59,428,000	53.6	31,840,510	51	54	57	57	1,305,300	10,355,594
1887	2,901,953	19.6	56,812,000	51.9	29,464,390	80	80	69	77	550,884	10,831,461
1888	2,996,382	21.3	63,884,000	59.0	37,672,032					1,440,321	11,368,414
1889	3,220,834	24.3	78,332,976	41.6	32,614,271	58	58			1,408,311	11,332,545
1890	3,135,302	21.4	67,168,344	62.7	42,140,502					973,062	5,078,733
1891	3,352,579	25.9	86,839,153	52.4	45,470,342					2,800,075	3,146,328
1892	3,400,361	23.6	80,096,762	47.5	38,026,062	65	67	65	65	3,035,267	1,970,129
1893	3,220,371	21.7	69,869,495	41.1	28,729,386	52	54	55	60	5,219,405	791,061
1894	3,170,602	19.4	61,400,465	44.2	27,134,127	53½	55½	51	52	1,563,754	2,116,816
1895	3,299,973	26.4	87,072,744	33.7	29,312,413	(b) 33	40	(b) 25	36	7,680,331	837,384
1896	2,950,539	23.6	69,695,223	32.3	22,491,241	22	37	24½	35	20,030,301	1,271,787
1897	2,719,116	24.5	66,685,127	37.7	25,142,139	25½	42	36	53	11,237,077	124,804
1898	2,583,125	21.6	55,792,257	41.3	23,064,359	40	50½	36	42	2,267,403	110,475
1899	2,878,229	25.5	73,381,563	40.3	29,594,254	35	45	36	44	23,661,662	189,757
1900	2,894,282	20.4	58,925,833	40.8	24,075,271	37	61	37	57	6,293,207	171,004
1901	4,295,744	25.6	109,932,924	45.2	49,705,163	56	63	64	72	8,714,268	57,406
1902	4,661,063	29.0	134,954,023	45.9	61,898,634	36	70	48	56	8,429,141	56,462
1903	4,993,137	26.4	131,861,391	45.6	60,166,313	42	61½	38	59	10,881,627	90,708
1904	5,145,878	27.2	139,748,958	42.0	58,651,807	38	52	40	50	10,661,655	81,020
1905	5,095,528	26.8	136,651,020	40.3	55,047,166	37	53	42	55½	17,729,360	18,049
1906	6,323,757	28.3	178,916,484	41.5	74,235,997	44	56	66	85	8,238,842	38,319
1907	6,448,000	23.8	153,597,000	66.6	102,290,000	78	102	60	75	4,349,078	199,741
1908	6,646,000	25.1	166,756,000	55.4	92,442,000	57	64½				

[a] Census figures.

[b] Prices from 1895 on are for No. 3 grade.

Average yield per acre of barley in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	19.8	21.2	24.2	28.8	29.0	27.4	27.5	29.4	29.9	32.7	29.0	31.5	28.0	28.0
New Hampshire	24.8	21.8	23.4	22.7	25.0	22.7	21.5	21.2	19.8	20.7	20.8	21.4	24.0	24.0
Vermont	24.8	25.4	26.0	31.2	31.0	29.1	29.6	29.7	29.2	33.1	31.5	32.8	28.5	33.0
Massachusetts	22.7	23.2	23.0	29.0	30.0	25.8	.....	.....	.....	.....	.....	.....	.....	.....
Rhode Island	24.1	21.9	.....	.....	29.0	28.0	.....	.....	.....	.....	.....	.....	.....	.....
New York	22.0	23.0	21.0	24.1	24.0	22.0	14.0	28.5	26.6	26.8	25.7	26.3	25.0	26.0
Pennsylvania	21.5	22.3	19.6	20.8	21.0	19.0	17.2	21.0	21.3	22.6	25.0	25.0	25.5	26.0
Maryland	20.9	.....	22.6	24.7	18.0	20.0	18.0	27.0	25.9	21.8	31.0	31.0	33.0	30.0
Virginia	16.3	15.7	18.4	24.1	14.3	22.0	24.9	18.3	24.4	24.7	28.0	28.6	29.0	28.0
Ohio	22.8	22.7	24.7	26.7	28.0	27.0	24.9	32.3	23.3	27.5	26.2	30.0	28.0	27.5
Indiana	21.9	22.7	20.9	24.6	25.0	24.6	25.4	28.0	22.8	29.2	28.0	29.4	20.5	23.0
Illinois	23.1	21.2	22.2	26.9	29.0	25.6	24.5	28.6	28.2	27.1	30.0	30.0	28.0	28.5
Michigan	22.1	24.0	21.5	24.5	24.0	23.9	22.8	28.6	25.2	24.1	27.0	26.1	22.0	25.5
Wisconsin	26.4	24.5	25.2	28.9	30.0	25.5	27.2	33.8	27.7	30.0	29.9	30.7	23.0	30.0
Minnesota	25.5	25.9	24.5	26.4	25.0	22.4	25.8	28.6	25.3	28.4	27.0	28.0	22.5	25.0
Iowa	25.2	22.6	22.6	25.6	26.0	26.4	23.6	26.3	23.4	27.8	26.0	28.3	25.5	27.0
Missouri	22.9	19.7	20.8	19.8	18.0	20.8	16.5	25.0	18.3	20.3	23.0	24.2	23.0	23.0
North Dakota	.....	.....	22.0	23.5	24.0	8.2	28.2	31.6	21.6	28.1	28.0	25.8	18.3	19.5
South Dakota	.....	.....	17.2	25.0	23.0	14.3	22.4	29.2	31.4	28.0	30.0	29.0	23.0	26.5
Nebraska	27.8	20.1	19.7	24.1	26.0	17.6	16.0	31.1	26.6	27.4	27.5	28.0	20.8	23.5
Kansas	24.5	19.2	18.6	19.6	17.0	21.5	15.9	16.0	31.9	21.6	22.0	23.5	12.0	16.0
Kentucky	19.6	22.3	24.0	21.2	21.0	28.6	19.4	25.9	21.4	20.6	24.0	26.0	25.0	25.0
Tennessee	19.5	14.9	15.8	17.3	11.0	14.7	16.8	16.0	20.6	22.0	21.6	23.0	20.0	25.0
Texas	25.1	20.3	15.4	21.4	18.0	24.6	13.5	21.3	24.4	31.0	24.0	24.5	17.0	24.0
Oklahoma	.....	.....	.....	28.2	28.0	27.0	22.0	36.0	26.9	30.1	26.0	29.8	18.7	23.0
Montana	.....	29.9	27.3	35.2	35.0	38.8	39.0	37.0	40.2	29.9	33.0	33.0	38.0	35.0
Wyoming	.....	.....	.....	28.0	20.0	32.0	32.5	24.4	21.3	30.1	31.7	31.4	32.0	35.0
Colorado	.....	22.6	26.9	29.5	28.0	24.8	28.7	26.3	38.3	37.1	33.0	41.0	40.0	33.0
New Mexico	.....	19.6	22.1	26.2	32.0	29.0	31.7	16.1	23.1	23.6	21.0	27.0	26.0	42.0
Arizona	.....	19.2	22.2	32.9	20.0	30.0	28.7	25.2	32.8	33.6	44.0	42.2	35.5	38.0
Utah	.....	22.3	26.5	34.4	33.0	36.5	35.0	32.1	37.5	38.3	37.0	44.0	39.0	45.0
Nevada	27.5	22.5	26.8	34.4	33.0	33.0	33.0	34.3	34.6	35.9	34.0	36.8	40.0	30.0
Idaho	.....	28.2	26.5	35.1	35.0	32.8	40.2	46.3	34.4	37.4	40.0	41.0	44.5	41.0
Washington	.....	30.4	30.3	37.9	35.0	33.4	43.5	43.7	37.9	34.8	40.0	36.5	40.5	30.5
Oregon	29.1	27.0	25.7	29.6	28.0	28.9	30.6	31.9	33.2	28.7	31.0	35.0	42.0	29.0
California	23.4	20.6	21.2	22.0	26.0	16.7	26.0	26.0	25.7	22.7	21.5	27.2	28.9	23.5
United States	22.9	22.4	22.6	25.1	25.5	20.4	25.6	29.0	26.4	27.2	26.8	28.3	23.8	25.1
Division:[a]														
North Atlantic	21.9	23.0	21.3	24.8	24.8	22.8	16.3	28.1	26.6	27.4	27.2	27.2	25.7	27.0
South Atlantic	17.0	14.7	19.4	24.2	16.2	21.0	22.5	21.5	25.0	23.7	29.1	29.5	30.3	28.5
N. Central E. of Miss. R	23.6	23.6	24.4	28.5	29.0	25.4	26.7	33.1	27.2	29.4	29.6	30.3	23.1	29.5
N. Central W. of Miss. R	25.3	22.6	22.4	25.2	23.9	20.3	24.1	28.2	25.3	27.8	27.2	27.4	21.1	23.7
South Central	20.0	20.8	19.5	25.8	16.4	22.2	19.6	31.4	25.7	29.5	25.2	28.3	18.7	23.2
Far Western	23.7	21.2	22.1	24.8	26.7	18.3	28.6	28.7	28.0	25.1	25.2	29.1	31.9	26.1

[a] See note *a*, page 599.

Average farm value per acre of barley in the United States December 1.

State, Territory, or Division.	10-year averages.				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	16.24	16.11	16.21	17.86	17.11	16.99	18.43	19.99	21.23	23.22	19.72	20.48	21.88	22.62
N. Hampshire	22.32	16.79	16.15	15.66	16.25	15.21	17.20	15.90	16.63	15.53	15.18	13.70	19.00	19.00
Vermont	23.06	19.81	16.38	16.85	16.12	15.13	19.54	18.12	17.52	21.85	21.18	20.34	21.36	23.07
Massachusetts	22.25	19.26	16.79	18.85	20.40	17.80	......	......	......	......	......	......	......	......
Rhode Island	22.90	18.62	18.54	18.18	20.30	21.56	......	......	......	......	......	......	......	......
New York	19.58	17.25	14.07	12.29	12.00	11.22	7.84	15.68	14.63	15.28	13.88	14.47	20.00	18.19
Pennsylvania	19.14	17.62	11.37	10.40	10.29	9.50	10.15	11.34	11.93	12.66	13.75	13.75	17.89	16.33
Maryland	16.72	20.90	11.75	13.09	6.84	9.00	9.36	13.23	12.95	13.95	14.88	14.57	20.00	20.00
Virginia	11.74	12.72	11.04	13.26	5.43	9.90	11.70	9.88	13.91	15.07	15.40	16.02	18.00	19.33
Ohio	19.15	16.57	13.83	12.28	12.60	11.61	12.70	15.83	11.65	14.30	11.79	13.80	19.61	17.60
Indiana	18.40	16.80	11.29	11.07	11.25	11.56	12.95	12.88	11.40	14.02	12.60	15.29	13.78	15.00
Illinois	16.17	13.14	11.32	11.57	13.63	12.03	12.99	12.58	12.41	11.65	12.60	12.60	16.08	18.53
Michigan	18.78	16.56	12.04	11.76	11.52	11.23	12.31	14.87	13.10	13.25	12.69	12.79	14.74	15.81
Wisconsin	19.80	14.2	12.35	11.85	12.00	11.22	13.87	15.55	13.30	12.90	12.26	13.82	17.25	17.40
Minnesota	15.56	12.48	10.29	8.71	7.75	8.51	11.61	10.58	9.36	9.09	8.64	9.80	15.08	12.25
Iowa	14.87	10.17	9.27	8.45	8.06	9.77	11.09	9.47	8.42	10.01	7.80	9.90	15.30	13.77
Missouri	19.46	13.00	10.19	9.11	7.56	9.36	9.08	13.75	9.88	12.59	10.12	11.62	13.00	14.50
N. Dakota	......	......	7.92	7.52	7.92	2.87	11.28	11.38	7.78	7.87	8.40	8.51	10.61	8.97
S. Dakota	......	......	6.19	7.50	6.67	4.43	9.41	11.10	10.36	8.96	8.70	9.28	14.03	12.45
Nebraska	17.24	7.44	7.49	7.23	7.80	5.81	6.56	10.26	8.78	8.49	8.52	8.68	10.40	10.81
Kansas	15.92	8.45	7.81	6.27	4.59	7.10	7.15	6.08	10.85	7.99	7.04	7.76	6.48	8.64
Kentucky	18.03	16.50	12.48	11.02	9.03	15.73	13.77	14.50	13.48	13.39	10.56	14.30	19.00	18.00
Tennessee	16.38	11.18	9.16	10.38	7.04	9.11	11.76	9.76	13.39	14.08	12.31	13.80	14.00	18.00
Texas	24.60	14.82	9.70	13.91	11.88	17.71	11.88	15.34	17.08	22.63	15.84	14.95	12.50	18.75
Oklahoma	......	......	......	12.13	11.20	8.64	10.78	15.12	11.84	12.04	10.40	9.83	9.34	13.33
Montana	......	23.32	15.83	19.01	17.85	18.62	22.23	18.87	23.32	18.54	18.48	18.48	23.53	21.56
Wyoming	......	......	......	18.48	12.60	17.60	21.12	18.30	15.34	17.16	18.70	20.10	21.75	22.75
Colorado	......	18.53	16.41	15.93	15.40	12.40	18.08	15.78	23.36	21.15	17.49	22.14	24.00	21.46
New Mexico	......	16.46	14.14	17.29	19.52	17.98	20.61	11.43	14.78	21.24	14.49	17.01	18.00	33.00
Arizona	......	14.59	14.43	26.65	12.40	19.20	19.52	22.93	23.62	31.25	35.64	32.07	27.69	32.31
Utah	......	13.83	14.04	17.89	17.16	20.07	18.55	18.94	22.13	21.83	19.61	23.76	22.64	24.33
Nevada	35.48	20.25	17.15	25.80	19.80	19.14	23.10	27.44	29.41	25.85	23.80	25.39	33.14	23.12
Idaho	......	21.15	14.04	16.85	16.10	16.40	21.31	24.54	17.89	23.56	19.20	20.50	25.82	21.73
Washington	......	17.02	15.15	16.68	15.40	13.03	17.83	20.10	18.95	17.05	18.80	17.89	23.49	17.69
Oregon	18.62	16.47	12.34	14.80	14.00	12.14	14.99	16.59	19.59	16.93	16.12	18.20	23.93	17.11
California	20.83	14.01	11.24	11.88	13.00	7.18	10.66	16.38	15.68	13.62	12.68	14.69	22.54	17.39
United States	18.09	13.84	11.03	10.34	10.28	8.32	11.57	13.28	12.05	11.40	10.80	11.74	15.86	13.91
Division:[a]														
N. Atlantic	19.43	17.34	14.14	12.97	12.72	11.93	9.66	15.88	15.15	16.27	15.04	15.44	20.15	19.01
S. Atlantic	15.38	13.38	11.31	13.12	6.14	9.45	10.87	11.12	13.55	14.66	15.21	15.47	18.57	19.49
N. Central E. of Miss. River	18.20	14.92	12.30	11.88	12.04	11.29	13.66	15.36	13.13	12.96	12.28	13.71	17.09	17.32
N. Central W. of Miss. River	15.66	10.10	9.12	8.16	7.37	7.31	10.68	10.31	9.04	8.89	8.36	9.24	12.98	11.45
S. Central	18.38	15.43	10.82	12.31	9.43	14.27	11.23	14.80	13.15	14.58	11.72	11.23	9.99	14.18
Far Western	21.26	14.46	11.74	13.17	13.26	7.91	12.27	17.11	16.61	14.81	14.14	15.61	22.97	18.14

[a] See note *a*, page 599.

Acreage, production, and value of barley in the United States in 1908.

State, Territory, or Division.	Acreage.	Production.	Farm value Dec. 1.	State, Territory, or Division.	Acreage.	Production.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Dollars.*		*Acres.*	*Bushels.*	*Dollars.*
Maine	8,000	224,000	181,000	Montana	25,000	875,000	534,000
New Hampshire	2,000	48,000	38,000	Wyoming	4,000	140,000	91,000
Vermont	14,000	462,000	323,000				
New York	77,000	2,002,000	1,401,000	Colorado	24,000	792,000	515,000
Pennsylvania	9,000	234,000	147,000	New Mexico	1,000	42,000	33,000
				Arizona	29,000	1,102,000	937,000
Maryland	1,000	30,000	20,000	Utah	12,000	540,000	292,000
Virginia	3,000	84,000	58,000	Nevada	8,000	240,000	185,000
Ohio	30,000	825,000	528,000				
Indiana	9,000	207,000	135,000	Idaho	52,000	2,132,000	1,130,000
Illinois	30,000	855,000	556,000	Washington	170,000	5,185,000	3,007,000
				Oregon	62,000	1,798,000	1,061,000
Michigan	70,000	1,785,000	1,107,000	California	1,082,000	25,427,000	18,816,000
Wisconsin	825,000	24,750,000	14,355,000				
Minnesota	1,300,000	32,500,000	15,925,000	United States	6,646,000	166,756,000	92,442,000
Iowa	500,000	13,500,000	6,885,000				
Missouri	2,000	46,000	29,000	Division: [a]			
				N. Atlantic	110,000	2,970,000	2,090,000
North Dakota	940,000	18,330,000	8,432,000	S. Atlantic	4,000	114,000	78,000
South Dakota	928,000	24,592,000	11,558,000	N. Central E. of Miss. River	964,000	28,422,000	16,681,000
Nebraska	118,000	2,773,000	1,276,000				
Kansas	275,000	4,400,000	2,376,000				
Kentucky	1,000	25,000	18,000	N. Central W. of Miss. River	4,063,000	96,141,000	46,481,000
Tennessee	1,000	25,000	18,000				
Texas	4,000	96,000	75,000	S. Central	36,000	836,000	511,000
Oklahoma	30,000	690,000	400,000	Far Western	1,469,000	38,273,000	26,601,000

[a] See note *a*, page 599.

Average farm price of barley per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan. 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Maine	82	76	67	62	59	62	67	68	71	71	68	65	78	81	77	75	86	89	87	80
New Hampshire	90	77	69	69	65	67	80	75	84	75	73	64	80	80	79	83	85	81	81	80
Vermont	93	78	63	54	52	52	66	61	60	66	54	62	75	70	73	77	85	89	85	75
Massachusetts	98	83	73	65	68	69	......	......	......	......	......	......	......	......	......	87	......	85	......	......
Rhode Island	95	85	76	64	70	77	......	......	......	......	......	......	......	......	......	......	......	89	......	......
New York	89	75	67	51	50	51	56	55	55	57	54	55	80	70	81	84	74	84	80	64
Pennsylvania	89	79	58	50	49	50	59	54	56	56	55	55	70	63	70	79	72	73	67	70
Maryland	80	81	52	53	38	45	52	49	50	64	48	47	60	65	52	40	60	65	62	65
Virginia	72	81	60	55	38	45	47	54	57	61	55	56	62	69	69	67	70	70	69	70
Ohio	84	73	56	46	45	43	51	49	50	52	45	46	70	64	72	70	72	70	64	65
Indiana	84	74	54	45	45	47	51	46	50	48	45	52	67	65	64	58	67	67	62	62
Illinois	70	62	51	43	47	47	53	44	44	43	42	42	67	65	68	71	69	65	65	65
Michigan	85	69	56	48	48	47	54	52	52	55	47	49	67	62	69	68	72	74	61	64
Wisconsin	75	58	49	41	40	44	51	46	48	43	41	45	75	58	76	72	72	64	59	55
Minnesota	61	48	42	33	31	38	45	37	37	32	32	35	67	49	76	67	60	52	51	48
Iowa	59	45	41	33	31	37	47	36	36	36	30	35	60	51	65	66	65	53	54	51
Missouri	85	66	49	46	42	45	55	55	54	62	44	48	57	63	61	66	68	60	70	63
North Dakota	......	......	36	32	33	35	40	36	36	28	30	33	58	46	68	65	60	48	48	44
South Dakota	......	......	36	30	29	31	42	38	33	32	29	32	61	47	74	64	61	53	51	47
Nebraska	62	37	38	30	30	33	41	33	33	31	31	31	50	46	55	54	55	50	48	47
Kansas	65	44	42	32	27	33	45	38	34	37	32	33	54	54	53	61	61	59	56	54
Kentucky	92	74	52	52	43	55	71	56	63	65	44	55	75	72	78	85	82	78	80	70
Tennessee	84	75	58	60	64	62	70	61	65	64	57	60	70	73	74	79	85	75	75	78
Texas	98	73	63	65	66	72	88	72	70	73	66	61	73	78	71	63	75	76	76	78
Oklahoma	......	......	......	43	40	32	49	42	44	40	40	33	50	58	50	64	......	61	48	60
Montana	......	78	58	54	51	48	52	51	58	62	56	56	62	61	65	60	67	59	63	66
Wyoming	......	......	......	66	63	55	65	75	72	57	59	64	68	65	60	64	68	67	70	69
Colorado	......	82	61	54	55	50	63	60	61	57	53	54	60	65	60	62	68	64	65	65
New Mexico	......	84	64	66	61	62	65	71	64	90	69	63	70	79	......	......	79	69	71	81
Arizona	......	76	65	81	62	64	68	91	72	93	81	76	78	85	......	87	85	85	86	84

Utah	....	62	53	52	52	55	53	59	59	57	53	54	58	54	60	56	60	62	60	55
Nevada	129	90	64	75	60	58	70	80	85	72	70	69	83	77	90	83	95	90	87	75
Idaho	....	75	53	48	46	50	53	53	52	63	48	50	58	53	50	56	50	60	49	54
Washington	....	56	50	44	44	39	41	46	50	49	47	49	58	58	53	56	55	55	52	55
Oregon	64	61	48	50	50	42	49	52	59	59	52	52	57	59	54	55	55	56	55	56
California	89	68	53	54	50	43	41	63	61	60	59	54	78	74	74	71	75	71	69	70
United States	79.0	61.8	48.8	41.2	40.3	40.8	45.2	45.9	45.6	42.0	40.3	41.5	66.6	55.4	70.4	66.8	65.4	58.1	56.1	53.7
Division:[a]																				
North Atlantic	88.7	75.4	66.4	52.3	51.3	52.3	59.1	56.5	56.9	59.3	55.2	56.8	78.4	70.4	78.7	82.0	76.5	84.0	80.1	67.0
South Atlantic	90.5	91.0	58.3	54.2	38.0	45.0	48.4	51.7	54.3	62.0	52.3	52.5	61.3	68.4	62.6	67.0	67.0	68.3	66.7	66.7
North Central East of Mississippi River	77.1	63.2	50.4	41.7	41.4	44.4	51.2	46.4	48.2	44.1	41.6	45.3	74.0	58.7	75.0	71.5	71.9	65.0	59.5	56.4
North Central West of Mississippi River	61.9	44.7	40.7	32.4	30.8	36.1	44.3	36.6	35.7	32.0	30.8	33.7	61.5	48.3	70.3	65.0	61.0	52.1	51.2	47.9
South Central	91.9	74.2	55.5	47.7	57.6	64.1	57.2	47.2	51.1	49.4	46.4	39.7	53.4	61.1	53.5	63.9	77.9	63.2	52.2	63.4
Far Western	89.7	68.2	53.1	53.1	49.7	43.2	42.9	59.7	59.3	58.9	56.2	53.6	72.0	69.5	67.9	67.0	69.6	68.1	65.9	67.1

[a] See note a, page 599.

Wholesale prices of barley per bushel, 1895–1908.

Date.	Cincinnati.		Chicago.		St. Louis.		Milwaukee.		San Francisco.	
	Extra No. 3 spring.[a]		No. 3.		Malting, medium to choice.		Extra No. 3.		No. 1 feed (per cwt.).[b]	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*		
1895	58	59	33	56½	......	......	......	......	$0.65	$0.97½
1896	35	36	20	40	......	......	......	......	.76¼	.95
1897	30	45	22	47	......	......	......	......	.82½	1.12½
1898	32	54	26½	53	......	......	......	......	.92½	1.42½
1899	44	56	34	54	......	......	......	......	.85	1.47½
1900	44¾	66	34	62	......	......	......	......	.67½	.75
1901	58	70	36	65	50	67	......	......	.73¾	.85
1902	55	74	35	73	48	70	......	......	.80	1.32½
1903	55	71	42	63	48	67	48	63	.90	1.22½
1904	55	69	35	61	42	65	41	61	.95	1.15
1905.										
January	52	58	38	50	44	53	43	51	1.16¼	1.23¾
February	52	58	37	48	45	53	44	50	1.22½	1.25
March	52	58	40	48	45	51	43½	50	1.22½	1.30
April	52	58	40	49½	47	48	43½	50	1.22½	1.30
May	54	58	40	50	......	......	45	50	1.22½	1.35
June	54	58	43	50	......	......	45	51	1.27½	1.35
July	54	58	40	52	......	......	45	52	1.10	1.30
August	54	58	37½	50	......	......	44	52	1.02½	1.10
September	54	58	37½	52	48	55	42	53½	1.05	1.13¾
October	54	58	36½	53	43	55	43½	54	1.10	1.30
November	54	58	37½	55	43	56	41	54	1.22½	1.27½
December	54	58	37	53	45	54	44	54	1.22½	1.27½
1906.										
January	53	58	38½	55	46	53½	44	54	......	......
February	53	58	38	51	45	52	45	54	......	......
March	53	58	39	53	45	53½	43½	54	......	......
April	55	60	39	53	c 41½	c 42	45	55	......	......
May	55	60	42	55½	c 46	c 47	45	54	......	......
June	55	60	43	58	c 47	c 51	48	56	......	......
July	55	60	40	54	c 41	c 45	45½	55	......	......
August	......	......	38	53	c 36	c 38	46	54	......	......
September	52	61	38	55	46	57	45	54	......	......
October	52	61	40	56	45	58	46	55	......	......
November	56	62	42	56	46	58	46	55	......	......
December	57	62	44	56	49	58½	49	55	......	......
									No. 1 brewing.	
1907.										
January	54	60	45	57	50	59	49	57	1.15	1.20
February	57	68	48	63	55	67	52½	65	1.12½	1.20
March	67	71	57	75	63	75	63½	74½	1.15	1.27½
April	69	77	60	74	70	73	66	74½	1.20	1.27½
May	74	92	66	85	80	80	70	85	1.25	1.30
June	90	92	66	76	66	66	68½	79	1.22½	1.27½
July	90	92	55	75	65	65	62	70	1.22½	1.32½
August	88	92	55	87	......	......	63½	87	1.30	1.37½
September	88	113	76	100	88	100	83	108	1.37½	1.55
October	108	113	70	110	80	115	72	111	1.45	1.72½
November	108	113	58	95	71	95	80	100	1.62½	1.72½
December	108	113	78	102	84	102	85	100	1.60	1.67½
			Low malting to fancy.						No. 1 feed.	
1908.										
January	113	115	78	106	84	98	85	105	1.35	1.57½
February	102	115	80	95	82	92	78	95	1.25	1.42½
March	102	110	72	93	......	......	75	90	1.25	1.42½
April	98	110	65	87	......	......	68	86	1.32½	1.42½
May	......	......	60	75	......	......	64	71	1.37½	1.50
June	......	......	49	66	......	......	50	66	1.22½	1.42½
July	......	......	57	74	......	......	60	61	1.25	1.40
August	68	70	60	68	......	......	59	67	1.25	1.38¾
September	67	73	56	67	......	......	56	65½	1.25	1.36¼
October	67	71	53	62	......	......	57	66	1.32½	1.42½
November	67	71	54½	67	60	65	58	66½	1.40	1.47½
December	67	69	57	64½	......	......	59	65¼	1.40	1.45

[a] No. 1 fall, 1895 and 1896. [b] No. 1 brewing, 1895 to 1903. [c] Feed barley.

RYE.

Rye crop of countries named, 1904–1908.

Country.	1904.	1905.	1906.	1907.	1908.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	27,242,000	28,486,000	33,375,000	31,566,000	31,851,000
Canada:					
Ontario	2,065,000	1,769,000	1,369,000	1,116,000	1,062,000
Manitoba	130,000	179,000	104,000	86,000	104,000
Other	800,000	800,000	800,000	371,000	599,000
Total Canada	2,995,000	2,748,000	2,273,000	1,573,000	1,765,000
Mexico	67,000	70,000	70,000	70,000	70,000
Total North America	30,304,000	31,304,000	35,718,000	33,209,000	33,686,000
EUROPE.					
Austria-Hungary:					
Austria	91,685,000	98,186,000	99,246,000	86,452,000	113,499,000
Hungary proper	43,880,000	50,544,000	51,962,000	39,445,000	45,185,000
Croatia-Slavonia	2,038,000	2,537,000	1,919,000	2,436,000	3,650,000
Bosnia-Herzegovina	360,000	374,000	388,000	271,000	295,000
Total Austria-Hungary	137,963,000	151,641,000	153,515,000	128,604,000	162,629,000
Belgium	21,990,000	21,349,000	20,569,000	23,484,000	20,000,000
Bulgaria	7,772,000	7,113,000	7,538,000	3,883,000	6,500,000
Denmark	16,465,000	19,249,000	18,828,000	15,893,000	18,000,000
Finland	10,362,000	11,552,000	11,000,000	11,000,000	12,000,000
France	52,141,000	58,116,000	50,429,000	55,896,000	51,858,000
Germany	396,075,000	378,204,000	378,948,000	384,150,000	422,692,000
Italy	3,000,000	4,000,000	4,000,000	4,000,000	3,000,000
Netherlands	13,517,000	13,742,000	13,938,000	14,483,000	14,500,000
Norway	717,000	982,000	963,000	823,000	869,000
Roumania	2,201,000	7,344,000	8,900,000	2,554,000	2,640,000
Russia:					
Russia proper	893,205,000	629,671,000	555,698,000	693,257,000	....
Poland	76,606,000	69,088,000	74,100,000	74,127,000	....
Northern Caucasia	8,170,000	9,933,000	8,877,000	6,807,000	....
Total Russia, European	977,981,000	708,692,000	638,675,000	774,191,000	[a] 783,100,000
Servia	1,031,000	1,103,000	1,560,000	911,000	1,000,000
Spain	17,276,000	26,502,000	31,828,000	27,027,000	26,412,000
Sweden	20,708,000	24,393,000	25,915,000	21,597,000	26,052,000
United Kingdom	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Total Europe	1,681,199,000	1,435,982,000	1,368,606,000	1,470,496,000	[a]1,553,252,000
ASIA.					
Russia:					
Central Asia	1,088,000	690,000	404,000	993,000	....
Siberia	29,360,000	28,043,000	27,752,000	32,931,000	....
Transcaucasia [b]	9,000	17,000	13,000	12,000	....
Total Russia, Asiatic	30,457,000	28,750,000	28,169,000	33,936,000	([c])
Total Asia	30,457,000	28,750,000	28,169,000	33,936,000	....
AUSTRALASIA.					
Australia:					
Queensland	2,000	1,000	1,000	3,000	....
New South Wales	83,000	35,000	51,000	50,000	....
Victoria	31,000	32,000	30,000	21,000	....
Western Australia	4,000	5,000	4,000	5,000	....
Tasmania	11,000	12,000	8,000	10,000	....
Total Australia	131,000	85,000	94,000	89,000	....
New Zealand	21,000	33,000	65,000	43,000	....
Total Australasia	152,000	118,000	159,000	132,000	135,000
Grand total	1,742,112,000	1,496,154,000	1,432,652,000	1,537,773,000	1,587,073,000

[a] Including Asiatic Russia. [b] Includes Chernomorsk only. [c] See note *a*.

Acreage, production, value, prices, and exports of rye in the United States, 1849–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including rye flour, fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*
1849 [a]	....	......	14,188,813	......	....	......	......	......	......	....
1859 [a]	....	......	21,101,380	......	....	......	......	......	......	....
1866	1,548,033	13.5	20,864,944	82.2	17,149,716	......	......	142	150	234,971
1867	1,689,175	13.7	23,184,000	100.4	23,280,584	132	157	173	185	564,901
1868	1,651,321	13.6	22,504,800	94.9	21,349,190	106½	118	100	115½	92,869
1869	1,657,584	13.6	22,527,900	77.0	17,341,861	66	77½	78	83½	199,450
1870	1,176,137	13.2	15,473,600	73.2	11,326,967	67	74	81	91	87,174
1871	1,069,531	14.4	15,365,500	71.1	10,927,623	62	63¾	75	93	832,689
1872	1,048,654	14.2	14,888,600	67.6	10,071,061	57½	70	68½	70	611,749
1873	1,150,355	13.2	15,142,000	70.3	10,638,258	70	81	91	102	1,923,404
1874	1,116,716	13.4	14,990,900	77.4	11,610,339	93	99½	103	107½	267,058
1875	1,359,788	13.0	17,722,100	67.1	11,894,223	67	68¾	61½	70½	589,159
1876	1,468,374	13.9	20,374,800	61.4	12,504,970	65½	73	70	92½	2,234,856
1877	1,412,902	15.0	21,170,100	57.6	12,201,759	55½	56½	54	60	4,249,684
1878	1,622,700	15.9	25,842,790	52.5	13,566,002	44	44½	47	52	4,877,821
1879	1,625,450	14.5	23,639,460	65.6	15,507,431	73½	81	73½	85	2,943,894
1880	1,767,619	13.9	24,540,829	75.6	18,564,560	82	91½	115	118	1,955,155
1881	1,789,100	11.6	20,704,950	93.3	19,327,415	96½	98	77	83	1,003,609
1882	2,227,894	13.4	29,960,037	61.5	18,439,194	57	58½	62	67	2,206,212
1883	2,314,754	12.1	28,058,582	58.1	16,300,503	56½	60	60½	62½	6,247,590
1884	2,343,963	12.2	28,640,000	51.9	14,857,040	51	52	68	73	2,974,390
1885	2,129,301	10.2	21,756,000	57.9	12,594,820	58½	61	58	61	216,699
1886	2,129,918	11.5	24,489,000	53.8	13,181,330	53	54½	54½	56½	377,302
1887	2,053,447	10.1	20,693,000	54.5	11,283,140	55½	61½	63	68	94,827
1888	2,364,805	12.0	28,415,000	58.8	16,721,869	50	52	39	41½	309,266
1889	2,171,493	13.1	28,420,299	42.3	12,009,752	44	45½	49½	54	2,280,975
1890	2,141,853	12.0	25,807,472	62.9	16,229,992	64½	68½	83	92	358,263
1891	2,176,466	14.6	31,751,868	77.4	24,589,217	86	92	70¼	79	12,068,628
1892	2,163,657	12.9	27,894,037	54.2	15,103,901	46	51	50½	62	1,493,924
1893	2,038,485	13.0	26,555,446	51.3	13,612,222	45	47½	44½	48	249,152
1894	1,944,780	13.7	26,727,615	50.1	13,395,476	47½	49	62½	67	32,045
1895	1,890,345	14.4	27,210,070	44.0	11,964,826	32	35¾	33	36½	1,011,128
1896	1,831,201	13.3	24,369,047	40.9	9,960,769	37	42½	32¾	35½	8,575,663
1897	1,703,561	16.1	27,363,324	44.7	12,239,647	45¾	47	48	75	15,562,035
1898	1,643,207	15.6	25,657,522	46.3	11,875,350	52½	55½	56½	62	10,169,822
1899	1,659,308	14.4	23,961,741	51.0	12,214,118	49	52	53	56¼	2,382,012
1900	1,591,362	15.1	23,995,927	51.2	12,295,417	45¾	49¾	51½	54	2,345,512
1901	1,987,505	15.3	30,344,830	55.7	16,909,742	59	65¾	54½	58	2,712,077
1902	1,978,548	17.0	33,630,592	50.8	17,080,793	48	49¼	48	50½	5,445,273
1903	1,906,894	15.4	29,363,416	54.5	15,993,871	50½	52½	69¾	78	784,068
1904	1,792,673	15.2	27,241,515	68.8	18,748,323	73	75	70	84	29,749
1905	1,730,159	16.5	28,485,952	61.1	17,414,138	64	68	58	62	1,387,826
1906	2,001,904	16.7	33,374,833	58.9	19,671,243	61	65	69	87½	769,717
1907	1,926,000	16.4	31,566,000	73.1	23,068,000	75	82	79	86	2,444,588
1908	1,948,000	16.4	31,851,000	73.6	23,455,000	75	77¼	83	90	....

[a] Census figures.

Average yield of rye in countries named, bushels per acre, 1888–1907.

Year.	United States.[a]	Russia, European.[b]	Germany.[b]	Austria.[b]	Hungary proper.[b]	France.[a]	United Kingdom.[a]
Average (1888 to 1897)	13.5	10.0	19.0	15.5	16.3	17.1	25.4
1898	15.6	10.6	24.2	17.7	16.9	18.3	25.5
1899	14.4	12.8	23.5	18.7	17.7	18.2	25.8
1900	15.1	12.7	22.9	13.0	15.1	16.9	25.7
1901	15.3	10.3	22.4	16.9	15.8	16.7	27.3
1902	17.0	12.5	24.6	18.2	19.1	14.3	28.1
1903	15.4	12.2	26.2	18.2	18.2	18.1	26.9
1904	15.2	13.7	26.3	19.3	17.1	16.6	26.0
1905	16.5	10.1	24.9	20.2	19.4	18.5	27.0
1906	16.7	8.8	25.1	19.9	19.8	16.3	27.6
1907	16.4	10.8	25.7	18.8	16.2	18.2	27.0
Average (1898 to 1907)	15.8	11.5	24.6	18.1	17.5	17.2	26.7

[a] Winchester bushels.
[b] Bushels of 56 pounds.

Condition of the rye crop in the United States on first of months named, 1888–1909.

Year.	December of previous year.	April.	May.	June.	July.	August.	When harvested.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1888	96.0	93.5	92.9	93.9	95.1	91.4	92.8
1889	97.2	93.9	96.5	95.2	96.7	95.4	91.6
1890	96.4	92.8	93.5	92.3	92.0	86.8	85.4
1891	99.0	95.4	97.2	95.4	93.9	89.6	95.1
1892	88.8	87.0	88.9	91.0	92.8	89.8	88.5
1893	89.4	85.7	82.7	84.6	85.3	78.5	82.0
1894	94.6	94.4	90.7	93.2	87.0	79.8	86.9
1895	96.2	87.0	88.7	85.7	80.7	84.0	83.7
1896	94.9	82.9	87.7	85.2	83.8	88.0	82.0
1897	99.8	88.9	88.0	89.9	93.4	89.8	90.1
1898	....	92.1	94.5	97.1	94.6	93.7	89.4
1899	98.9	84.9	85.2	84.5	84.9	89.0	82.0
1900	98.2	84.8	88.5	87.6	84.0	76.0	84.2
1901	99.1	93.1	94.1	93.9	93.5	83.6	84.9
1902	89.9	85.4	83.4	88.1	90.3	90.5	90.2
1903	98.1	97.9	93.3	90.6	89.3	87.2	84.1
1904	92.7	82.3	81.2	86.3	89.1	91.8	86.9
1905	90.5	92.1	93.5	95.3	92.9	92.6	90.8
1906	95.4	90.9	93.0	89.9	91.3	90.8	90.5
1907	96.2	92.0	88.0	88.1	89.7	88.9	....
1908	91.4	89.1	90.3	91.3	91.2	88.3	....
1909	87.6	87.2	88.1	89.6	91.4	....	....

Acreage, production, and value of rye in the United States in 1908.

State, Territory, or Division.	Acreage.	Production.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Dollars.*
Vermont	2,000	30,000	27,000
Massachusetts	4,000	66,000	63,000
Connecticut	10,000	185,000	166,000
New York	145,000	2,392,000	1,938,000
New Jersey	78,000	1,264,000	1,024,000
Pennsylvania	343,000	5,660,000	4,358,000
Delaware	1,000	16,000	13,000
Maryland	19,000	285,000	219,000
Virginia	15,000	188,000	154,000
West Virginia	10,000	130,000	110,000
North Carolina	14,000	125,000	122,000
South Carolina	4,000	38,000	52,000
Georgia	14,000	122,000	152,000
Ohio	49,000	808,000	614,000
Indiana	63,000	945,000	699,000
Illinois	71,000	1,214,000	886,000
Michigan	368,000	5,704,000	4,050,000
Wisconsin	275,000	5,225,000	3,710,000
Minnesota	88,000	1,628,000	1,026,000
Iowa	53,000	1,060,000	678,000
Missouri	15,000	192,000	146,000
North Dakota	24,000	432,000	281,000
South Dakota	32,000	560,000	330,000
Nebraska	85,000	1,360,000	816,000
Kansas	45,000	598,000	425,000
Kentucky	13,000	176,000	150,000
Tennessee	8,000	100,000	90,000
Alabama	2,000	20,000	25,000
Texas	4,000	62,000	61,000
Oklahoma	3,000	40,000	32,000
Arkansas	2,000	20,000	19,000
Montana	2,000	40,000	27,000
Wyoming	1,000	22,000	16,000
Colorado	3,000	46,000	32,000
Utah	3,000	46,000	30,000
Idaho	2,000	40,000	27,000
Washington	3,000	58,000	52,000
Oregon	9,000	162,000	138,000
California	66,000	792,000	697,000
United States	1,948,000	31,851,000	23,455,000
Division:[a]			
North Atlantic	582,000	9,597,000	7,576,000
South Atlantic	77,000	904,000	822,000
N. Central E. of Miss. R.	825,000	13,896,000	9,959,000
N. Central W. of Miss. R.	342,000	5,830,000	3,702,000
South Central	32,000	418,000	377,000
Far Western	90,000	1,206,000	1,019,000

[a] See note *a*, page 599.

Average yield per acre of rye in the United States.

State, Territory, or Division.	10-year averages.				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	16.6	14.2	13.4	16.3	15.0	17.2	.....	.....	.....	.....	.....	.....	.....	.....
New Hampshire	17.0	12.3	13.4	.....	15.0	17.1	.....	.....	.....	.....	.....	.....	.....	.....
Vermont	16.5	15 9	13.8	17.4	17.0	16.6	18.3	16.9	19.4	16.9	15.0	17.4	17.0	15.0
Massachusetts	16.6	15.1	14.5	16.8	16.0	16.9	15.9	15.2	13.7	17.0	15.5	15.0	16.5	16.5
Connecticut	14.4	14.1	13.7	17.5	18.0	17.0	18.0	17.4	17.0	16.9	18.0	18.0	17.0	18.5
New York	14.2	13.0	13.6	16.0	16.0	15.1	14.9	17.5	15.2	14.8	16.0	17.6	16.5	16.5
New Jersey	13.7	11.8	12.4	15.8	15.0	15.9	15.0	16.4	13.8	17.5	18.0	17.2	17.5	16.2
Pennsylvania	13.6	12.0	12.6	16.1	15.0	15.3	15.9	16.0	15.6	15.5	17.0	17.4	16.7	16.5
Delaware	9.0	10.9	8.0	13.1	16.0	15.5	15.3	13.5	14.8	11.8	10.0	15.0	16.5	15.5
Maryland	11.9	11.8	11.1	14.3	14.0	16.5	14.4	14.0	13.7	14.8	14.5	14.7	16.0	15.0
Virginia	10.1	7.9	8.2	11.2	9.0	10.5	11.1	9.6	12.2	15.7	11.8	13.4	14.0	12.5
West Virginia	13.0	10.2	9.3	11.0	10.0	10.5	12.0	8.1	11.5	12.5	11.8	12.2	12.0	13.0
North Carolina	8.8	7.0	6.4	8.6	7.0	8.9	8.5	8.2	8.8	9.9	9.5	11.0	10.5	8.9
South Carolina	6.2	5.0	5.6	7.1	5.0	7.5	7.7	7.6	7.6	7.5	8.1	8.5	10 0	9.6
Georgia	7.2	5.6	5.8	7.3	6.0	7.0	7.6	6.3	7.9	8.3	7.7	8.3	9.0	8.7
Ohio	12.6	13.2	14.3	16.1	16.0	16.6	16.9	17.5	15.3	16.1	18.0	19.5	17.2	16.5
Indiana	14.0	12.4	13.9	13.9	13.0	15.1	14.5	14.5	12.6	14.6	15.4	17.0	17.0	15.0
Illinois	16.1	16.3	14.7	16.6	15.0	17.2	17.0	19.1	16.5	17.6	18.0	17.0	18.5	17.1
Michigan	15.6	13.0	13.4	14.5	14.0	14.6	14.0	17.9	15.5	13.2	16.0	14.5	14.5	15.5
Wisconsin	15.9	14.6	14.0	16.1	15.0	15.8	15.9	18.9	16.6	16.2	16.5	17.0	18.0	19.0
Minnesota	18.7	16.6	16.1	18.7	18.0	19.5	19.3	22.3	18.4	17.7	18.2	19.3	18.5	18.5
Iowa	18.4	13.4	15.3	17.6	18.0	18.0	18.4	17.4	16.9	17.2	17.5	18.6	17.8	20.0
Missouri	16.3	13.4	12.7	13.9	13.0	14.0	14.2	18.2	12.8	14.4	15.5	15.8	15.4	12.8
North Dakota	.....	.....	13.9	14.9	15.0	5.2	13.8	20.2	15.7	18.5	19.5	18.7	16.0	18.0
South Dakota	.....	....	10.0	15.9	15.0	10.6	14.4	18.8	20.2	16.5	19.0	18.8	17.0	17.5
Nebraska	19.6	15.3	12.0	16.6	16.0	14.2	15.0	20.3	14.2	15.8	18.0	21.0	17.0	16.0
Kansas	19.3	17.4	11.0	13.4	11.0	15.2	14.3	12.0	16.2	13.2	15.7	16.0	12.0	13.3
Kentucky	11.0	10.3	10.8	12.8	10.0	13.1	14.0	13.4	11.6	13.7	15.0	15.2	13.7	13.5
Tennessee	9.6	7.5	7.4	10.9	9.0	11.0	11.3	11.0	13.4	11.7	12.1	13.0	10.0	12.5
Alabama	8.6	5.4	7.9	9.5	8.0	7.8	8.0	10.0	10.6	10.4	11.7	12.5	10.5	10.0
Texas	15.9	12.9	9.0	12.0	10.0	16.5	11.1	9.9	14.2	13.1	14.0	14.6	10.0	15.5
Oklahoma	.....	.....	.....	14.0	14.0	19.0	14.8	16.0	17.9	9.4	12.1	13.9	10.0	13.5
Arkansas	13.0	8.9	8.0	10.9	11.0	11.5	8.7	12.3	9.7	11.1	12.0	12.0	9.9	10.0
Montana	.....	.....	.....	23.2	25.0	23.0	26.7	25.0	24.6	19.9	20.0	20.5	22.0	20.0
Wyoming	.....	.....	.....	20.5	18.0	18.3	24.0	18.0	18.0	19.5	23.0	19.0	21.5	22.0
Colorado	.....	17.9	16.1	17.6	14.0	16.8	16.1	15.9	18.3	19.1	19.0	20.0	20.5	15.5
Utah	.....	10.2	13.9	16.3	17.0	17.5	14.2	12.4	16.1	16.0	18.0	24.0	20.0	15.5
Idaho	.....	.....	12.5	19.7	35.0	18.0	15.0	20.2	18.5	19.7	25.0	25.2	24.7	20.0
Washington	.....	16.4	15.3	17.9	16.0	16.3	17.5	17.8	21.0	19.0	18.5	19.6	21.5	19.5
Oregon	24.7	18.3	12.8	14.2	11.0	16.1	15.7	13.4	14.2	14.4	15.0	17.2	16.0	18.0
California	22.2	12.4	12.6	12.1	15.0	13.0	12.8	12.0	12.3	7.6	13.0	12.8	19.0	12.0
United States	13.6	13.3	12.7	15.4	14.4	15.1	15.3	17.0	15.4	15.2	16.5	16.7	16.4	16.4
Division:[a]														
North Atlantic	14.0	12.5	13.0	16.1	15.5	15.4	15.6	16.5	15.3	15.6	16.9	17.4	16.8	16.5
South Atlantic	10.4	8.0	8.0	10.6	8.9	10.6	10.7	9.5	10.9	12.4	11.1	12.0	12.5	11.7
N. Central E. of Miss. R.	15.3	15.0	14.1	15.6	14.7	15.9	15.5	18.4	16.0	15.6	16.6	16.0	16.3	16.8
N. Central W. of Miss. R.	17.5	14.5	10.9	16.5	15.0	15.9	16.1	18.6	16.2	16.1	17.6	18.8	16.0	17.0
South Central	10.9	9.4	9.4	11.9	9.7	12.5	12.3	12.3	12.9	12.2	13.3	14.0	11.2	13.1
Far Western	22.5	12.9	13.2	13.3	14.7	14.0	13.9	12.9	13.5	9.9	14.1	14.7	19.0	13.4

[a] See note a, page 599.

Average farm value per acre of rye in the United States December 1.

State, Territory, or Division.	10-year averages.				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	18.09	13.63	11.66	13.04	12.60	14.10	......	......	......	......	......	......	......	......
N. Hampshire	17.85	11.19	10.99	13.75	12.15	14.02	......	......	......	......	......	......	......	......
Vermont	16.83	13.20	10.07	11.66	10.54	10.13	14.64	13.01	12.61	12.51	9.75	10.79	12.78	13.50
Massachusetts	16.93	12.84	11.02	12.43	12.64	12.68	12.56	12.16	10.00	13.94	12.25	9.75	14.87	15.75
Connecticut	15.12	11.98	9.86	11.90	11.52	11.05	12.96	13.05	12.07	13.35	13.32	11.88	13.77	16.60
New York	12.21	9.49	8.57	9.28	8.96	8.46	9.24	10.15	9.27	10.80	10.72	11.44	13.36	13.37
New Jersey	12.33	8.85	7.81	9.16	8.25	8.74	8.85	10.00	8.83	12.25	11.88	10.49	13.30	13.13
Pennsylvania	11.15	8.76	7.56	8.86	7.65	8.11	9.54	8.48	9.67	11.01	11.05	11.14	12.52	12.71
Delaware	7.47	7.52	4.96	8.38	8.00	7.75	8.87	8.37	9.03	8.61	6.60	9.60	14.00	13.00
Maryland	9.52	8.26	6.55	8.15	7.98	8.58	8.06	8.12	8.08	11.25	9.43	8.82	11.98	11.53
Virginia	7.27	5.29	4.92	6.61	4.77	6.09	6.77	6.34	8.05	11.62	8.38	9.38	11.22	10.27
W. Virginia	10.27	7.14	5.95	7.04	6.20	6.72	7.80	5.51	8.17	9.63	8.26	8.54	9.91	11.00
N. Carolina	7.83	5.53	4.99	6.62	5.25	6.76	6.63	6.97	7.39	8.61	8.17	9.35	10.21	8.71
S. Carolina	8.37	6.15	5.43	7.53	5.45	7.87	8.55	8.59	8.13	9.45	9.64	10.63	12.63	13.00
Georgia	9.36	6.66	5.63	7.66	6.72	7.21	8.06	6.93	9.01	8.47	8.39	8.72	11.24	10.86
Ohio	9.20	8.58	8.01	8.69	8.80	9.13	9.30	9.27	8.87	11.91	11.16	11.12	12.91	12.53
Indiana	9.52	8.06	7.23	6.95	6.24	7.55	7.68	6.67	6.68	10.07	9.24	9.86	12.23	11.10
Illinois	9.34	9.45	7.35	8.30	7.05	8.08	9.69	9.55	8.58	12.32	10.80	9.52	13.13	12.48
Michigan	11.23	8.32	7.24	7.25	7.28	7.01	7.28	8.77	7.90	9.50	9.44	8.56	10.44	11.01
Wisconsin	9.54	8.47	7.00	7.89	7.20	7.74	8.27	9.45	8.30	11.18	9.73	9.86	12.96	13.49
Minnesota	9.91	8.63	7.24	8.23	7.56	8.19	9.46	9.59	8.28	11.33	9.65	9.65	12.21	11.66
Iowa	9.02	6.83	6.88	7.74	7.20	7.38	9.20	7.31	7.44	10.32	9.27	9.30	11.39	12.79
Missouri	10.27	7.64	6.22	7.51	6.50	7.14	9.51	8.74	7.04	9.22	9.61	9.48	11.10	9.73
N. Dakota	......	......	5.84	6.11	5.55	2.13	5.93	8.69	6.75	11.10	9.75	8.79	9.58	11.71
S. Dakota	......	......	4.20	6.36	5.55	4.13	6.19	7.71	8.08	9.41	9.31	8.46	10.52	10.31
Nebraska	10.78	6.27	4.80	6.47	6.08	5.68	6.90	7.31	5.25	8.69	8.64	9.24	10.02	9.60
Kansas	11.97	7.48	4.84	6.16	4.62	6.54	7.87	5.40	7.13	8.58	8.48	8.00	7.91	9.44
Kentucky	8.47	7.11	6.70	8.19	7.00	8.25	9.38	8.31	8.00	10.96	10.65	10.64	11.87	11.54
Tennessee	7.97	6.52	5.03	7.41	6.03	7.48	8.36	8.03	9.92	9.24	9.32	9.62	8.78	11.25
Alabama	11.09	6.43	7.82	10.16	8.32	8.03	8.32	10.50	11.45	12.48	13.34	13.12	13.12	12.50
Texas	16.54	11.48	6.93	9.24	8.20	11.05	10.32	7.52	10.51	11.27	11.90	12.41	10.00	15.25
Oklahoma	......	......	......	8.26	5.32	8.36	10.36	7.52	8.95	5.83	7.50	7.92	7.39	10.67
Arkansas	14.60	7.92	6.00	8.50	8.14	8.28	7.74	8.98	8.15	9.77	11.16	9.96	8.82	9.50
Montana	......	......	......	15.31	11.50	12.19	16.02	16.00	15.50	15.32	13.00	13.53	15.24	13.50
Wyoming	......	......	......	12.30	9.00	9.70	19.20	9.00	12.42	7.80	14.26	13.68	15.00	16.00
Colorado	......	13.78	9.98	10.03	6.72	9.07	9.98	8.90	11.16	12.41	10.64	11.20	12.61	10.67
Utah	......	6.94	7.51	9.29	8.16	9.10	9.23	7.56	10.46	10.72	11.70	15.60	12.89	10.00
Idaho	......	8.64	7.38	12.80	20.30	15.84	10.05	12.12	12.02	14.77	14.00	15.12	15.29	13.50
Washington	......	12.46	10.40	11.46	9.60	9.45	10.85	11.39	15.12	15.01	12.95	12.74	16.55	17.33
Oregon	21.00	14.64	8.45	10.37	7.70	9.82	10.36	9.78	13.77	12.82	12.15	12.73	13.17	15.33
California	25.31	10.91	8.57	8.47	11.70	7.54	7.30	9.00	9.47	5.93	10.01	9.09	16.16	10.56
United States	10.62	8.45	6.97	8.08	7.36	7.73	8.51	8.63	8.39	10.46	10.07	9.83	11.98	12.04
Division:[a]														
N. Atlantic	12.04	9.30	8.09	9.16	8.42	8.46	9.48	9.20	9.53	11.17	11.13	11.12	12.89	13.02
S. Atlantic	8.60	6.16	5.36	7.00	5.87	7.00	7.37	6.96	8.08	10.09	8.61	9.07	11.12	10.64
N. Central E. of Miss. River	9.52	8.85	7.26	7.74	7.25	7.77	8.18	9.11	8.15	10.88	9.81	9.30	11.75	12.05
N. Central W. of Miss. River	9.90	7.21	4.79	7.05	6.10	6.67	7.92	7.58	6.83	9.67	9.07	9.05	10.52	10.80
S. Central	8.79	7.06	6.22	8.09	6.94	8.30	9.05	8.20	9.18	9.88	10.30	10.42	10.08	11.81
Far Western	24.75	10.93	8.63	9.18	10.68	8.05	8.27	9.30	10.44	7.76	10.58	10.21	15.54	11.32

[a] See note *a*, page 599.

Average farm price of rye per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan. 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
Maine	109	96	87	80	84	82	......	......	......	......	......	......	......	......	......	......	......	......	......	......
New Hampshire	105	91	82	79	81	82	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Vermont	102	83	73	67	62	61	80	77	65	74	65	62	78	90	78	76	90	92	100	87
Massachusetts	102	85	76	74	79	75	79	80	73	82	79	65	90	95	95	88	89	92	103	99
Connecticut	105	85	72	68	64	65	72	75	71	79	74	66	81	90	81	88	84	89	91	91
New York	86	73	63	58	56	56	62	58	61	73	67	65	81	81	80	83	84	84	78	75
New Jersey	90	75	63	58	55	55	59	61	64	70	66	61	76	81	75	78	78	76	79	79
Pennsylvania	82	73	60	55	51	53	60	53	62	71	65	64	75	77	77	77	79	80	78	79
Delaware	83	69	62	64	50	50	58	62	61	73	66	64	80	82	79	80	80	74	78	80
Maryland	80	70	59	57	57	52	56	58	59	76	65	60	75	77	70	75	74	74	78	77
Virginia	72	67	60	59	53	58	61	66	66	74	71	70	80	82	80	79	82	82	80	81
West Virginia	79	70	64	64	62	64	65	68	71	77	70	70	82	85	78	84	83	85	86	85
North Carolina	89	79	78	77	75	76	78	85	84	87	86	.85	97	98	96	97	98	97	97	100
South Carolina	135	123	97	106	109	105	111	113	107	126	119	125	125	137	126	144	125	131	130	130
Georgia	130	119	97	105	112	103	106	110	114	102	109	105	125	125	135	137	130	130	140	137
Ohio	73	65	56	54	55	55	55	53	58	74	62	57	75	76	74	77	74	74	74	75
Indiana	68	65	52	50	48	50	53	46	53	69	60	58	72	74	74	72	71	71	71	73
Illinois	58	58	50	50	47	47	57	50	52	70	60	56	71	73	74	71	72	73	73	74
Michigan	72	64	54	50	52	48	52	49	51	72	59	59	72	71	73	74	74	75	69	71
Wisconsin	60	58	50	49	48	49	52	50	50	69	59	58	72	71	70	73	73	73	67	70
Minnesota	53	52	45	44	42	42	49	43	45	64	53	50	66	63	66	69	65	65	65	64
Iowa	49	51	45	44	40	41	50	42	44	60	53	50	64	64	66	66	68	66	65	65
Missouri	63	57	49	54	50	51	67	48	55	64	62	60	72	76	69	72	80	74	75	75
North Dakota	......	......	42	41	37	41	43	43	43	60	50	47	60	65	59	63	65	66	62	61
South Dakota	......	......	42	40	37	39	43	41	40	57	49	45	62	59	62	62	62	65	59	58
Nebraska	55	41	40	39	38	40	46	36	37	55	48	44	59	60	62	63	63	62	61	61
Kansas	62	43	44	46	42	43	55	45	41	65	54	50	66	71	70	69	68	69	72	71
Kentucky	77	69	62	64	70	63	67	62	69	80	71	70	86	85	82	84	85	78	82	84
Tennessee	83	87	68	68	67	68	74	73	74	79	77	74	88	90	88	87	89	84	91	91
Alabama	129	119	99	107	101	103	104	105	108	120	114	105	125	123	123	118	125	115	115	134
Texas	104	89	77	77	82	67	93	76	74	86	85	85	100	98	102	95	100	87	97	86
Oklahoma	......	......	......	59	38	44	70	47	50	62	62	57	74	80	72	85	68	84	77	76
Arkansas	113	89	75	78	74	72	89	73	84	83	93	83	90	94	105	96	90	93	103	93

Montana	......	......	......	66	46	53	60	64	63	77	65	66	68	68	65	69	68	65	63	79
Wyoming	......	......	......	60	50	53	80	50	69	40	62	72	66	71	60	58	75	65	73	70
Colorado	......	77	62	57	48	54	62	56	61	65	56	56	62	70	60	70	80	70	63	81
Utah	......	68	54	57	48	52	65	61	65	67	65	65	65	65	69	60	70	70	57	65
Idaho	......	67	59	65	58	88	67	60	65	75	56	60	63	68	60	65	64	69	64	67
Washington	......	76	68	64	60	58	62	64	72	79	70	65	77	90	70	82	80	72	72	85
Oregon	85	80	66	73	70	61	66	73	97	89	81	74	82	85	75	81	65	79	78	78
California	114	88	68	70	78	58	57	75	77	78	77	71	85	88	79	78	76	77	77	78
United States	78.1	63.5	54.9	52.5	51.0	51.2	55.7	50.8	54.5	68.8	61.1	58.9	73.1	73.6	73.3	74.5	74.7	75.4	72.8	73.7
Division:[a]																				
North Atlantic	86.0	74.4	62.2	56.9	54.4	55.1	60.8	55.9	62.2	71.6	65.9	63.9	76.7	78.9	77.6	78.8	80.2	80.5	78.6	78.5
South Atlantic	82.7	77.0	67.0	66.0	66.0	66.3	69.0	73.0	73.9	81.2	77.5	75.6	89.0	90.9	88.1	91.2	90.1	94.0	96.8	95.0
North Central East of Mississippi River	62.2	59.0	51.5	49.6	49.2	49.0	52.8	49.6	50.8	69.9	59.3	58.2	72.1	71.7	72.1	73.4	73.2	73.9	69.1	71.3
North Central West of Mississippi River	56.6	49.7	43.9	42.7	40.6	41.9	49.2	40.7	42.2	60.0	51.4	48.1	63.4	63.5	64.7	66.1	65.6	65.5	64.7	64.0
South Central	80.6	75.1	66.2	68.0	71.7	66.1	73.7	66.9	70.9	80.9	77.3	74.6	90.0	90.2	89.3	89.4	89.3	85.4	83.9	92.6
Far Western	110.0	84.7	65.4	69.0	72.7	57.7	59.6	72.1	77.3	78.1	74.8	69.7	81.8	84.5	76.0	76.7	74.5	76.1	76.0	78.9

[a] See note [a], page 599.

Wholesale prices of rye per bushel, 1895–1908.

Date.	Philadelphia. Low.	Philadelphia. High.	Cincinnati. No. 2. Low.	Cincinnati. No. 2. High.	Chicago. No. 2. Low.	Chicago. No. 2. High.	Duluth. Low.	Duluth. High.	San Francisco (per cwt.). Low.	San Francisco (per cwt.). High.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.		
1895	......	......	40	75	32	70	29	63	......	......
1896	......	......	26½	44	28	43	28½	40	......	......
1897	......	......	33	52	31	56	30	53	......	......
1898	......	......	40	80	41	75	40½	72	......	......
1899	......	......	56	68	49	62	47	59½	......	......
1900	......	......	51½	67	44½	60½	46	60½	......	......
1901	58	71½	45	73	46¼	65¼	46½	62½	$0.75	$0.87½
1902	54	71	51	71½	48	67½	46	64	.77½	1.15
1903	56	68½	54	63	48	60	48	55¼	1.10	1.30
1904	65	96	61	87	51	81	54½	80	1.25	1.47½
1905.										
January	81	87½	80	86	74½	75½	72½	75	1.42½	1.50
February	80	90¼	81½	86	74	78	73	75	1.45	1.60
March	80	83½	84	87	75	78½	73½	78	1.50	1.60
April	79½	83	80	86	73	78½	74	77	1.50	1.65
May	......	......	80	83	70	84	70	78	1.55	1.65
June	72	75	80	83	75	79	70	78	1.60	1.75
July	63	66	60	83	58	75	57½	72	1.40	1.50
August	65¾	69½	56	60	57½	60	55½	58	1.47½	1.52½
September	70	76½	56	66	60	72	59	64	1.50	1.52½
October	73¼	76	67	74	67	73½	63	65	1.45	1.52½
November	68	73	70	74½	66	72½	62	66½	1.45	1.47½
December	66½	73	70	72	64	68	62	60	1.45	1.50
1906.										
January	65	67	68	70½	65	68	60	60	......	......
February	63	65	65	70	63	65	60	61	......	......
March	58½	63	66	70	58½	63	56	59	......	......
April	58	62½	66	70	58	62½	56	57	......	......
May	58	62	66	69	58	62	57	57	......	......
June	60	61½	62	69	60	62	57	57	......	......
July	56	60	58	64	56	60	53	57	......	......
August	55½	56½	58	62	55½	56½	53	53	......	......
September	55½	62	60	66	55½	63	53	56	......	......
October	62	62½	65	68½	60	62½	56	59½	......	......
November	60	65	66½	72	60	65	58	61	......	......
December	61	65	69	72½	61	65	60	61	......	......
1907.										
January	75	77	68	71	60	63	57	60	1.42½	1.47½
February	75	80	69	73	64	70	60	60	1.35	1.42½
March	75	80	71	74	64	70	60	60½	1.35	1.45
April	77	82	73	75	67	72	60	64	1.40	1.50
May	79	89	73	84	69	87½	64	78	1.40	1.50
June	93	98	81	88	84	88¾	80	82½	1.40	1.50
July	93	98	80	88	83	88	74	80	1.45	1.50
August	75	86	79	88	69	86	66	74	1.42½	1.50
September	90	95	84	91	85	91¼	75	85	1.40	1.47½
October	80	100	81	93	72	90	75	86	1.37½	1.45
November	85	95	79	84	75	80	67	76	1.40	1.45
December	85	95	78	84	75	82	70	76	1.40	1.52½
1908.										
January	93	95	81	89	79	87	71	78	1.45	1.52½
February	93	95	85	89	80	85	74	78	1.47½	1.52½
March	94	95	85	89	74	85	69	80	1.47½	1.52½
April	94	95	82	84	74	81	69	74	1.43¾	1.50
May	92	94	82	86	79	86	71	76	1.43¾	1.50
June	90	92	84	86	72	80	66	76	1.45	1.52½
July	90	92	78	86	72	80	60	73	1.45	1.50
August	80	85	78	81	75	78¾	71½	75	1.35	1.45
September	80	85	78	80	75½	77	71	74	1.40	1.45
October	81	86	78	82	74	76½	68½	74	1.40	1.47½
November	82	86	78	80	73	76	67	71	1.45	1.50
December	82	86	78	80	75	77½	67	72	1.42½	1.50

BUCKWHEAT.

Acreage, production, and value of buckwheat in the United States, 1849–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
1849 [a]			8,956,912		
1859 [a]			17,571,818		
1866	1,045,624	21.8	22,791,839	67.6	15,413,160
1867	1,227,826	17.4	21,359,000	78.7	16,812,070
1868	1,113,993	17.8	19,863,700	78.0	15,490,426
1869	1,028,693	16.9	17,431,100	71.9	12,534,851
1870	536,992	18.3	9,841,500	70.5	6,937,471
1871	413,915	20.1	8,328,700	74.5	6,208,165
1872	448,497	18.1	8,133,500	73.5	5,979,222
1873	454,152	17.3	7,837,700	75.0	5,878,629
1874	452,590	17.7	8,016,600	72.9	5,843,645
1875	575,530	17.5	10,082,100	62.0	6,254,564
1876	666,441	14.5	9,668,800	66.6	6,435,836
1877	649,923	15.7	10,177,000	66.9	6,808,180
1878	673,100	18.2	12,246,820	52.6	6,441,240
1879	639,900	20.5	13,140,000	59.8	7,856,191
1880	822,802	17.8	14,617,535	59.4	8,682,488
1881	828,815	11.4	9,486,200	86.5	8,205,705
1882	847,112	13.0	11,019,353	73.0	8,038,862
1883	857,349	8.9	7,668,954	82.2	6,303,980
1884	879,403	12.6	11,116,000	58.9	6,549,020
1885	914,394	13.8	12,626,000	55.9	7,057,363
1886	917,915	12.9	11,869,000	54.5	6,465,120
1887	910,506	11.9	10,844,000	56.5	6,122,320
1888	912,630	13.2	12,050,000	63.3	7,627,647
1889	837,162	14.5	12,110,329	50.5	6,113,119
1890	844,579	14.7	12,432,831	57.4	7,132,872
1891	849,364	15.0	12,760,932	57.0	7,271,506
1892	861,451	14.1	12,143,185	51.8	6,295,643
1893	815,614	14.9	12,122,311	58.4	7,074,450
1894	789,232	16.1	12,668,200	55.6	7,040,238
1895	763,277	20.1	15,341,399	45.2	6,936,325
1896	754,898	18.7	14,089,783	39.2	5,522,339
1897	717,836	20.9	14,997,451	42.1	6,319,188
1898	678,332	17.3	11,721,927	45.0	5,271,462
1899	670,148	16.6	11,094,473	55.7	6,183,675
1900	637,930	15.0	9,566,966	55.8	5,341,413
1901	811,164	18.6	15,125,939	56.3	8,523,317
1902	804,889	18.1	14,529,770	59.6	8,654,704
1903	804,393	17.7	14,243,644	60.7	8,650,733
1904	793,625	18.9	15,008,336	62.2	9,330,768
1905	760,118	19.2	14,585,082	58.7	8,565,499
1906	789,208	18.6	14,641,937	59.6	8,727,443
1907	800,000	17.9	14,290,000	69.8	9,975,000
1908	803,000	19.8	15,874,000	75.6	12,004,000

[a] Census figures.

Condition of the buckwheat crop in the United States on first of months named, 1888–1908.

Year.	Aug.	Sept.	When harvested.	Year.	Aug.	Sept.	When harvested.	Year.	Aug.	Sept.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*
1888	92.5	93.7	79.1	1895	85.2	87.5	84.8	1902	91.4	86.4	80.5
1889	95.2	92.1	90.0	1896	96.0	93.2	86.0	1903	93.9	91.0	83.0
1890	90.1	90.5	90.7	1897	94.9	95.1	90.8	1904	92.8	91.5	88.7
1891	97.3	96.6	92.7	1898	87.2	88.8	76.2	1905	92.6	91.8	91.6
1892	92.9	89.0	85.6	1899	93.2	75.2	70.2	1906	93.2	91.2	84.9
1893	88.8	77.5	73.5	1900	87.9	80.5	72.8	1907	91.9	77.4	80.1
1894	82.3	69.2	72.0	1901	91.1	90.9	90.5	1908	89.4	87.8	81.6

Acreage, production, and value of buckwheat in the United States in 1908.

State, Territory, or Division.	Acreage.	Production.	Farm value, December 1.
	Acres.	*Bushels.*	*Dollars.*
Maine	23,000	690,000	518,000
New Hampshire	2,000	43,000	34,000
Vermont	8,000	176,000	123,000
Massachusetts	2,000	36,000	29,000
Connecticut	3,000	55,000	44,000
New York	319,000	6,827,000	5,189,000
New Jersey	12,000	240,000	180,000
Pennsylvania	260,000	4,992,000	3,744,000
Delaware	1,000	30,000	22,000
Maryland	9,000	166,000	126,000
Virginia	20,000	360,000	259,000
West Virginia	21,000	378,000	306,000
North Carolina	5,000	82,000	64,000
Ohio	13,000	240,000	197,000
Indiana	7,000	119,000	93,000
Illinois	5,000	91,000	82,000
Michigan	55,000	742,000	527,000
Wisconsin	20,000	304,000	231,000
Minnesota	5,000	91,000	66,000
Iowa	9,000	140,000	109,000
Missouri	1,000	20,000	17,000
Nebraska	1,000	18,000	15,000
Kansas	1,000	19,000	17,000
Tennessee	1,000	15,000	12,000
United States	803,000	15,874,000	12,004,000
Division: [a]			
North Atlantic	629,000	13,059,000	9,861,000
South Atlantic	56,000	1,016,000	777,000
North Central East of Mississippi River	100,000	1,496,000	1,130,000
North Central West of Mississippi River	17,000	288,000	224,000
South Central	1,000	15,000	12,000
Far Western	....	....	....

[a] See note *a*, page 599.

Average yield per acre of buckwheat in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	23.1	21.6	23.4	31.0	22.0	30.0	31.7	30.4	29.8	32.5	30.0	28.0	28.0	30.0
New Hampshire	19.8	19.1	19.9	22.5	20.0	22.0	21.0	20.0	19.6	25.1	23.0	22.0	22.0	21.5
Vermont	21.3	20.7	21.8	24.4	23.0	25.0	25.1	25.0	24.0	26.3	19.0	21.0	22.0	22.0
Massachusetts	14.8	13.5	16.3	17.8	20.0	17.0	18.9	14.4	13.7	16.2	20.0	20.0	21.0	18.0
Connecticut	17.1	12.9	13.8	17.1	19.0	16.0	18.0	18.4	17.5	16.3	16.0	17.0	16.0	18.2
New York	20.0	14.8	15.8	17.7	13.0	14.0	18.8	17.7	18.3	18.8	19.0	19.0	17.5	21.4
New Jersey	17.2	14.3	13.4	19.6	21.0	16.0	19.0	22.5	18.1	20.8	21.0	18.0	16.5	20.0
Pennsylvania	19.0	14.6	14.7	18.2	20.0	14.0	19.5	18.1	16.5	18.8	20.0	19.0	18.0	19.2
Delaware	19.5	.....	14.6	16.4	18.0	13.0	17.8	15.2	15.2	12.1	17.0	17.0	24.0	30.0
Maryland	17.5	15.3	12.9	17.0	13.0	15.0	17.5	17.0	16.3	18.2	19.0	18.0	19.0	18.5
Virginia	15.1	13.2	10.4	16.2	14.0	13.0	15.9	16.6	18.6	17.0	18.0	19.0	19.0	18.0
West Virginia	16.7	13.8	12.9	19.1	17.0	17.0	20.6	22.5	17.2	19.1	19.0	18.0	18.5	18.0
North Carolina	17.2	10.2	10.6	15.2	17.0	13.0	15.6	14.5	12.1	14.7	15.0	14.0	15.5	16.4
Ohio	14.4	12.5	12.7	16.9	16.0	16.0	16.1	13.9	16.6	16.9	17.0	19.0	19.5	18.5
Indiana	16.0	12.9	11.6	16.7	16.0	14.0	13.1	17.6	16.8	16.1	17.0	16.0	15.5	17.0
Illinois	14.8	12.3	12.1	14.6	15.0	15.0	11.0	15.5	15.3	17.9	16.0	19.0	17.0	18.2
Michigan	17.1	14.6	13.6	14.6	11.0	14.0	14.1	13.0	15.5	15.4	16.0	13.0	15.5	13.5
Wisconsin	16.3	12.8	12.0	15.3	15.0	14.0	12.4	16.0	15.6	17.7	15.0	15.0	16.0	15.2
Minnesota	16.9	12.8	12.3	14.7	17.0	15.0	14.5	13.9	15.2	15.1	14.0	14.0	14.7	18.2
Iowa	18.2	12.9	12.1	15.3	16.0	15.0	13.5	16.0	15.1	14.8	13.0	12.0	15.0	15.5
Missouri	18.8	14.3	10.9	14.6	14.0	13.0	6.0	16.0	14.8	13.5	16.0	18.0	16.0	20.1
Nebraska	19.9	13.1	9.4	15.4	16.0	16.0	11.5	14.7	19.0	11.7	14.0	15.0	14.5	18.0
Kansas	18.3	13.3	10.4	12.7	12.0	16.0	7.9	12.0	18.4	14.0	11.0	17.0	12.0	18.7
Tennessee	12.3	11.9	9.7	16.4	12.0	14.0	14.2	18.0	14.7	15.5	16.0	16.0	15.0	15.3
Oregon [f]	22.3	14.7	16.8	16.6	17.0	13.0	....	....	....	....	....	....	....	....
United States	18.3	14.6	14.7	18.1	16.6	15.0	18.6	18.1	17.7	18.9	19.2	18.6	17.9	19.8
Division: [a]														
North Atlantic	19.7	15.1	15.8	18.6	17.0	15.1	19.7	18.6	18.1	19.5	19.8	19.3	18.1	20.8
South Atlantic	16.7	13.5	12.3	17.2	15.4	15.5	18.0	18.7	17.0	17.6	18.2	17.9	18.6	18.1
N. Central E. of Miss. R.	16.1	13.2	12.7	15.2	13.9	14.3	13.5	14.5	15.7	16.5	15.9	14.7	16.2	15.0
N. Central W. of Miss. R.	18.0	13.2	11.4	14.8	16.2	15.0	12.2	14.6	15.4	14.6	13.5	13.6	14.8	16.9
South Central	12.4	11.7	10.0	16.0	12.0	14.0	14.2	18.0	14.7	15.5	16.0	16.0	15.0	15.3
Far Western	23.1	20.0	19.0	17.6	17.0	13.0	....	....	....	....	....	....	....	....

[a] See note *a*, page 599.

Average farm value per acre of buckwheat in the United States December 1.

State, Territory, or Division.	10-year averages.				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	15.48	12.10	12.87	14.88	9.68	14.70	15.22	15.81	15.20	16.90	19.50	16.52	18.22	22.52
N. Hampshire	13.07	12.03	11.34	13.05	10.00	11.44	11.55	13.00	11.56	17.07	16.33	16.06	16.50	17.00
Vermont	14.06	12.42	11.34	12.44	11.96	12.50	14.81	14.00	13.20	14.73	9.69	12.18	15.38	15.38
Massachusetts	11.54	9.45	11.08	11.93	14.00	12.24	11.53	10.66	9.32	11.66	14.20	13.60	15.00	14.50
Connecticut	14.71	9.68	8.83	10.94	11.97	10.40	11.70	13.06	12.42	11.90	11.68	12.75	12.00	14.67
New York	14.00	9.62	8.53	9.38	7.67	7.98	10.72	10.44	10.80	11.47	11.21	11.59	12.25	16.27
New Jersey	14.79	10.44	8.17	11.17	11.76	9.44	9.88	14.40	11.58	13.73	13.23	10.80	12.42	15.00
Pennsylvania	14.44	9.93	8.09	9.65	10.80	7.70	10.92	11.04	10.56	11.84	11.20	10.83	12.42	14.40
Delaware	15.99	9.25	8.32	8.20	8.82	6.76	9.79	9.12	8.36	7.50	9.69	10.37	17.00	22.00
Maryland	13.82	10.40	7.87	9.86	7.28	8.55	10.50	10.37	10.27	11.47	11.97	10.80	12.78	14.00
Virginia	9.82	8.45	6.14	8.91	7.56	7.15	8.90	9.96	11.35	10.88	11.16	11.02	13.89	12.95
W. Virginia	12.52	9.11	8.13	11.27	9.52	9.52	12.15	13.95	11.70	13.75	12.54	11.70	13.86	14.57
N. Carolina	10.66	6.73	5.83	8.97	8.33	7.28	9.67	8.99	7.86	10.44	9.90	8.96	11.00	12.80
Ohio	11.52	9.38	8.00	9.80	9.28	9.28	9.66	8.48	10.79	12.17	10.54	10.83	14.69	15.15
Indiana	11.26	9.68	7.08	10.02	9.44	8.54	7.99	10.21	11.76	11.27	11.05	10.24	11.25	13.29
Illinois	10.80	9.22	7.26	9.34	8.70	9.75	7.70	11.01	11.17	13.96	10.88	14.25	13.50	16.40
Michigan	11.29	9.49	7.21	7.30	6.05	7.14	7.19	6.89	8.37	9.39	8.48	7.15	10.07	9.58
Wisconsin	10.11	8.19	6.36	8.26	9.45	8.26	7.32	9.44	9.52	11.15	8.40	9.30	11.50	11.55
Minnesota	12.17	8.19	6.64	7.79	8.84	8.55	8.99	7.92	8.06	9.06	7.98	7.56	10.80	13.20
Iowa	12.74	9.03	7.50	9.33	9.28	9.60	9.45	11.20	10.72	9.92	9.10	9.12	12.00	12.11
Missouri	12.60	9.58	6.98	10.22	8.54	8.97	4.56	9.34	11.10	11.48	13.12	13.32	14.00	17.00
Nebraska	17.51	9.82	5.64	9.55	9.92	10.24	6.67	7.79	13.11	13.38	8.82	9.30	12.00	15.00
Kansas	15.92	10.51	7.38	9.52	6.00	11.20	5.92	9.00	14.35	11.20	7.59	12.58	10.00	17.00
Tennessee	10.09	8.45	5.63	10.33	6.84	8.26	8.38	13.68	9.70	11.01	10.88	13.28	12.00	12.00
Oregon	24.75	11.61	10.92	10.96	12.58	10.01	......	......	......	......	......	......	......	......
United States	13.27	9.67	8.08	9.68	9.23	8.37	10.51	10.75	10.75	11.76	11.27	11.06	12.47	14.95
Division: [a]														
N. Atlantic	14.28	9.98	8.63	9.86	9.40	8.34	11.03	11.05	10.93	11.93	11.57	11.48	12.56	15.70
S. Atlantic	12.21	8.91	7.52	9.82	8.52	8.70	10.50	11.44	10.90	11.92	11.64	11.02	13.48	13.85
N. Central E. of Miss. R	10.93	9.12	6.91	8.16	8.31	8.15	7.57	8.37	9.39	10.65	8.99	8.56	11.19	11.32
N. Central W. of Miss. R	13.01	9.23	6.82	8.85	9.16	9.29	8.18	9.38	10.33	10.12	9.09	9.35	11.71	13.15
S. Central	10.25	8.17	5.45	10.67	6.84	8.26	8.38	13.68	9.70	11.01	10.88	13.28	12.00	12.24
Far Western	25.87	15.34	11.68	9.38	12.58	10.01	......	......	......	......	......	......	......	......

[a] See note *a*, page 590.

Average farm price of buckwheat per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan. 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Maine	67	56	55	48	44	49	48	52	51	52	65	59	65	75	68	67	70	81	84	71
New Hampshire	66	63	57	58	50	52	55	65	59	68	71	73	75	80	75	87	77	79	80	77
Vermont	66	60	52	51	52	50	59	56	55	56	51	58	70	70	70	65	78	78	75	70
Massachusetts	78	70	68	67	70	72	61	74	68	72	71	68	70	80	75	75	75	90	90	85
Connecticut	86	75	64	64	63	65	65	71	71	73	73	75	75	80	76	91	80	90	90	85
New York	70	65	54	53	59	57	57	59	59	61	59	61	70	76	73	76	80	90	83	79
New Jersey	86	73	61	57	56	59	52	64	64	66	63	60	75	75	78	98	85	100	85	80
Pennsylvania	76	68	55	53	54	55	56	61	64	63	56	57	69	75	70	68	75	83	79	76
Delaware	82	69	57	50	49	52	55	60	55	62	57	61	69	72	72	75	80	90	80	75
Maryland	79	68	61	58	56	57	60	61	63	63	63	60	67	76	68	64	78	80	83	75
Virginia	65	64	59	55	54	55	56	60	61	64	62	58	73	72	75	71	80	86	74	69
West Virginia	75	66	63	59	56	56	59	62	68	72	66	65	75	81	77	78	81	83	82	78
North Carolina	62	66	55	59	49	56	62	62	65	71	66	64	71	78	75	81	91	99	87	77
Ohio	80	75	63	58	58	58	60	61	65	72	62	57	75	82	78	74	76	82	78	77
Indiana	71	75	61	60	59	61	61	58	70	70	65	64	73	78	77	75	74	83	78	80
Illinois	73	75	60	64	58	65	70	71	73	78	68	75	80	90	90	62	89	85	93	92
Michigan	66	65	53	50	55	51	51	53	54	61	53	55	65	71	63	67	67	79	65	72
Wisconsin	62	64	53	54	63	59	59	59	61	63	56	62	72	76	76	70	72	80	77	77
Minnesota	72	64	54	53	52	57	62	57	53	60	57	54	73	73	66	68	67	79	71	69
Iowa	70	70	62	61	58	64	70	70	71	67	70	76	80	78	80	93	78	100	78	75
Missouri	67	67	64	70	61	69	76	58	75	85	82	74	90	85	86	69	90	103	88	80
Nebraska	88	75	60	62	62	64	58	53	69	91	63	62	88	83	90	88	110	......	85	91
Kansas	87	79	71	75	50	70	75	75	78	80	69	74	82	91	90	80	......	......	140	100
Tennessee	82	71	58	63	57	59	59	76	66	71	68	83	80	80	85	65	90	90	90	87
Oregon	111	79	65	66	74	77	......	......	......	......	......	......	......	......	......	......	......	......	......	......
United States	72.5	66.2	55.0	53.5	55.7	55.8	58.3	59.6	60.7	62.2	58.7	59.6	69.8	75.6	71.7	72.4	77.0	86.0	80.0	77.1
Division: *a*																				
North Atlantic	72.5	66.1	54.6	53.0	55.3	55.4	56.0	59.5	60.4	61.3	53.3	59.4	69.4	75.5	71.6	72.6	77.4	86.8	81.4	77.7
South Atlantic	73.1	66.0	61.1	57.1	55.2	56.1	58.4	61.2	64.1	67.7	64.0	61.6	72.5	76.5	74.4	73.4	80.9	85.1	79.9	74.1
North Central East of Mississippi River	67.9	69.1	54.4	53.7	59.6	56.9	55.9	57.6	59.7	64.7	56.7	58.4	69.1	75.5	69.9	68.8	70.8	80.0	71.0	75.0
North Central West of Mississippi River	72.3	69.9	59.8	59.8	56.6	61.9	66.8	64.2	66.9	69.4	67.4	68.8	79.1	77.8	77.7	83.4	77.0	93.5	80.6	76.5
South Central	82.7	69.8	54.5	66.7	57.0	59.0	59.0	76.0	66.0	71.0	68.0	83.0	80.0	80.0	85.0	65.0	90.0	90.0	90.0	100.0
Far Western	112.0	73.7	61.5	53.3	74.0	77.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......

a See note *a*, page 599.

POTATOES.

Potato crop of countries named, 1903–1907.

[No statistics for Switzerland, Portugal, Argentina, Transvaal, Egypt, and some other less important potato-growing countries.]

Country.	1903.	1904.	1905.	1906.	1907.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	247,128,000	332,830,000	260,741,000	308,038,000	297,942,000
Canada:					
Ontario	17,202,000	15,967,000	14,819,000	15,494,000	20,908,000
Manitoba	4,907,000	3,919,000	2,901,000	4,281,000	4,150,000
New Brunswick	4,835,000	5,550,000	5,693,000	5,522,000	5,183,000
Saskatchewan and Alberta	[a] 1,000,000	[a] 1,000,000	2,844,000	5,507,000	5,338,000
Other	[a] 29,000,000	[a] 29,000,000	[a] 29,000,000	[a] 29,000,000	36,657,000
Total Canada	56,944,000	55,436,000	55,257,000	59,804,000	72,236,000
Mexico	539,000	527,000	469,000	[b] 469,000	[b] 469,000
Newfoundland [a]	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000
Total North America	305,961,000	390,143,000	317,817,000	369,661,000	371,997,000
SOUTH AMERICA.					
Chile	10,349,000	6,131,000	6,532,000	[b] 6,532,000	[b] 6,532,000
EUROPE.					
Austria-Hungary:					
Austria	357,121,000	398,298,000	581,822,000	514,289,000	538,789,000
Hungary proper	165,386,000	110,402,000	168,221,000	179,083,000	177,004,000
Croatia-Slavonia	19,337,000	9,311,000	12,589,000	12,854,000	[c] 12,854,000
Bosnia-Herzegovina	2,322,000	2,450,000	2,485,000	3,011,000	[c] 3,011,000
Total Austria-Hungary	544,166,000	520,461,000	765,117,000	709,237,000	731,658,000
Belgium	86,580,000	91,632,000	57,159,000	88,652,000	88,192,000
Denmark	25,256,000	24,214,000	29,954,000	28,454,000	24,005,000
Finland	19,212,000	15,465,000	20,704,000	20,432,000	[c] 20,432,000
France	426,422,000	451,039,000	523,876,000	372,076,000	404,181,000
Germany	1,576,361,000	1,333,326,000	1,775,579,000	1,577,653,000	1,673,246,000
Italy [d]	29,000,000	29,000,000	29,000,000	29,000,000	29,000,000
Malta	628,000	733,000	387,000	378,000	793,000
Netherlands	73,394,000	94,421,000	87,043,000	95,503,000	94,401,000
Norway	22,851,000	17,253,000	25,832,000	20,995,000	16,956,000
Roumania	5,246,000	3,001,000	3,733,000	4,636,000	3,860,000
Russia:					
Russia proper	675,330,000	705,170,000	686,502,000	630,211,000	694,487,000
Poland	194,829,000	179,997,000	331,529,000	296,662,000	327,689,000
Northern Caucasia	17,441,000	8,741,000	14,857,000	12,844,000	11,932,000
Total Russia (European)	887,600,000	893,908,000	1,032,888,000	939,717,000	1,034,108,000
Servia	1,527,000	718,000	1,232,000	1,799,000	876,000
Spain [d]	84,000,000	84,000,000	84,000,000	84,000,000	84,000,000
Sweden	59,317,000	51,314,000	74,819,000	63,829,000	52,270,000
United Kingdom:					
Great Britain	108,779,000	133,961,000	140,474,000	128,005,000	111,159,000
Ireland	88,227,000	98,635,000	127,793,000	99,328,000	83,869,000
Total United Kingdom	197,006,000	232,596,000	268,267,000	227,333,000	195,028,000
Total Europe	4,038,566,000	3,843,081,000	4,779,590,000	4,263,694,000	4,453,006,000
ASIA.					
Japan	9,824,000	11,274,000	16,255,000	20,244,000	[c] 20,244,000
Russia (Asiatic)	19,364,000	18,800,000	18,865,000	16,481,000	17,076,000
Total Asia	29,188,000	30,074,000	35,120,000	36,725,000	37,320,000
AFRICA.					
Algeria	1,596,000	1,655,000	1,605,000	1,684,000	1,803,000
Cape of Good Hope	[e] 1,600,000	1,942,000	[a] 2,000,000	[a] 2,000,000	[a] 2,000,000
Natal	345,000	451,000	466,000	454,000	444,000
Total Africa	3,541,000	4,048,000	4,071,000	4,138,000	4,247,000

[a] Estimated from returns for census year.
[b] 1905 figures.
[c] 1906 figures.
[d] Average production.
[e] Estimated from statistics for 1899 and 1904.

Potato crop of countries named, 1903–1907—Continued.

Country.	1903.	1904.	1905.	1906.	1907.
AUSTRALASIA.					
Australia:	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Queensland	122,000	659,000	718,000	422,000	591,000
New South Wales	1,147,000	2,118,000	1,820,000	1,881,000	4,288,000
Victoria	6,300,000	6,262,000	3,467,000	4,207,000	6,229,000
South Australia	1,057,000	1,173,000	729,000	756,000	832,000
Western Australia	242,000	170,000	210,000	235,000	188,000
Tasmania	6,105,000	6,395,000	4,127,000	2,412,000	6,807,000
Total Australia	14,973,000	16,777,000	11,071,000	10,013,000	18,935,000
New Zealand	7,215,000	7,795,000	5,025,000	4,607,000	6,342,000
Total Australasia	22,188,000	24,572,000	16,096,000	14,620,000	25,277,000
Grand total	4,409,793,000	4,298,049,000	5,159,226,000	4,695,370,000	4,898,379,000

Condition of the potato crop in the United States on the first of months named, 1888–1908.

Year.	July.	Aug.	Sept.	Oct.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*
1888	95.7	93.2	91.6	86.8
1889	95.1	94.3	81.7	77.9
1890	91.7	77.4	65.7	61.7
1891	95.3	96.5	94.8	91.3
1892	90.0	86.8	74.8	67.7
1893	94.8	86.0	71.8	71.2
1894	92.3	74.0	62.4	64.3
1895	91.5	89.7	90.8	87.4
1896	99.0	94.8	83.2	81.7
1897	87.8	77.9	66.7	61.6
1898	95.5	83.9	77.7	72.5
1899	93.8	93.0	86.3	81.7
1900	91.3	88.2	80.0	74.4
1901	87.4	62.3	52.2	54.0
1902	92.9	94.8	89.1	82.5
1903	88.1	87.2	84.3	74.6
1904	93.9	94.1	91.6	89.5
1905	91.2	87.2	80.9	74.3
1906	91.5	89.0	85.3	82.2
1907	90.2	88.5	89.2	77.0
1908	89.6	82.9	73.7	68.7

Acreage, production, and value of potatoes in the United States in 1908.

State, Territory, or Division.	Acreage.	Production.	Farm value December 1.
	Acres.	*Bushels.*	*Dollars.*
Maine	116,000	26,100,000	15,921,000
N. Hampshire	19,000	1,900,000	1,387,000
Vermont	27,000	1,971,000	1,321,000
Massachusetts	32,000	3,040,000	2,584,000
Rhode Island	6,000	900,000	774,000
Connecticut	34,000	2,720,000	2,448,000
New York	425,000	34,850,000	26,138,000
New Jersey	73,000	5,256,000	4,678,000
Pennsylvania	277,000	19,944,000	15,955,000
Delaware	8,000	656,000	544,000
Maryland	32,000	2,464,000	1,823,000
Virginia	57,000	5,016,000	3,612,000
W. Virginia	34,000	2,856,000	2,428,000
N. Carolina	25,000	1,975,000	1,521,000
S. Carolina	9,000	729,000	802,000
Georgia	10,000	780,000	858,000
Florida	5,000	415,000	560,000
Ohio	170,000	13,090,000	10,079,000
Indiana	90,000	5,130,000	4,309,000
Illinois	156,000	11,076,000	9,193,000
Michigan	325,000	23,400,000	13,572,000
Wisconsin	252,000	20,160,000	12,096,000
Minnesota	145,000	11,020,000	6,171,000
Iowa	141,000	11,280,000	6,768,000
Missouri	85,000	6,800,000	5,032,000
N. Dakota	30,000	2,550,000	1,428,000
S. Dakota	45,000	4,050,000	2,066,000
Nebraska	91,000	7,098,000	3,904,000
Kansas	86,000	6,880,000	5,710,000
Kentucky	38,000	2,356,000	1,908,000
Tennessee	28,000	2,240,000	1,590,000
Alabama	15,000	1,275,000	1,211,000
Mississippi	8,000	728,000	677,000
Louisiana	13,000	1,066,000	931,000
Texas	50,000	3,550,000	3,479,000
Oklahoma	27,000	2,106,000	2,064,000
Arkansas	30,000	2,460,000	2,116,000
Montana	20,000	2,760,000	1,932,000
Wyoming	6,000	948,000	626,000
Colorado	56,000	7,000,000	4,200,000
New Mexico	1,000	100,000	90,000
Utah	12,000	1,920,000	1,056,000
Nevada	3,000	360,000	270,000
Idaho	15,000	1,950,000	1,170,000
Washington	38,000	4,560,000	3,055,000
Oregon	43,000	4,257,000	2,895,000
California	49,000	5,243,000	4,037,000
United States	3,257,000	278,985,000	197,039,000
Division:[a]			
N. Atlantic	1,009,000	96,681,000	71,206,000
S. Atlantic	180,000	14,891,000	12,148,000
N. Central E. of Miss. R.	993,000	72,856,000	49,249,000
N. Central W. of Miss. R.	623,000	49,678,000	31,079,000
S. Central	209,000	15,781,000	14,026,000
Far Western	243,000	29,098,000	19,331,000

[a] See note *a*, page 599.

Acreage, production, value, prices, exports, etc., of potatoes in the United States, 1849–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1	Farm value Dec. 1.	Chicago, price per bushel, Burbank. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, fiscal year beginning July 1.	Imports during fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1849 [a]	....	......	65,797,896	......	....	......	......	......	......	155,595	....
1859 [a]	....	......	111,148,867	......	....	......	......	......	......	380,372	....
1866	1,069,381	100.2	107,200,976	47.3	50,722,553	......	......	......	......	512,380	198,265
1867	1,192,195	82.0	97,783,000	65.9	64,462,486	......	......	......	......	378,605	209,555
1868	1,131,552	93.8	106,090,000	59.3	62,918,660	......	......	......	......	508,249	138,470
1869	1,222,190	109.5	133,886,000	42.9	57,481,362	......	......	......	......	596,968	75,336
1870	1,325,119	86.6	114,775,000	65.0	74,621,019	......	......	......	......	553,070	458,758
1871	1,220,912	98.7	120,461,700	53.9	64,905,189	......	......	......	......	621,537	96,259
1872	1,331,331	85.3	113,516,000	53.5	60,692,129	......	......	......	......	515,306	346,840
1873	1,295,139	81.9	106,089,000	65.2	69,153,709	......	......	......	......	497,413	549,073
1874	1,310,041	80.9	105,981,000	61.5	65,223,314	......	......	......	......	600,642	188,757
1875	1,510,041	110.5	166,877,000	34.4	57,357,515	......	......	......	......	704,379	92,148
1876	1,741,983	71.7	124,827,000	61.9	77,319,541	......	......	......	......	529,650	3,205,555
1877	1,792,287	94.9	170,092,000	43.7	74,272,500	......	......	......	......	744,409	528,584
1878	1,776,800	69.9	124,126,650	58.7	72,923,575	......	......	......	......	625,342	2,624,149
1879	1,836,800	98.9	181,626,400	43.6	79,153,673	......	......	......	......	696,080	721,868
1880	1,842,510	91.0	167,659,570	48.3	81,062,214	......	......	......	......	638,840	2,170,372
1881	2,041,670	53.5	109,145,494	91.0	99,291,341	......	......	......	......	408,286	8,789,860
1882	2,171,636	78.7	170,972,508	55.7	95,304,844	......	......	......	......	439,443	2,362,302
1883	2,289,275	90.9	208,164,425	42.2	87,848,991	......	......	......	......	554,613	425,408
1884	2,220,980	85.8	190,642,000	39.6	75,524,290	......	......	......	......	380,868	658,633
1885	2,265,823	77.2	175,029,000	44.7	78,153,403	......	......	33	50	494,948	1,937,416
1886	2,287,136	73.5	168,051,000	46.7	78,441,940	44	47	65	90	434,864	1,432,490
1887	2,357,322	56.9	134,103,000	68.2	91,506,740	70	83	65	85	403,880	8,259,538
1888	2,533,280	79.9	202,365,000	40.2	81,413,589	30	37	24	45	471,955	883,380
1889	2,647,989	77.4	204,881,441	35.4	72,610,934	33	45	30	60	406,618	3,415,578
1890	2,651,579	55.9	148,289,696	75.8	112,341,708	82	93	95	110	341,189	5,401,912
1891	2,714,770	93.7	254,423,607	35.8	91,012,962	30	40	30	50	557,022	186,871
1892	2,547,962	61.5	156,654,819	66.1	103,567,520	60	72	70	98	845,720	4,317,021
1893	2,605,186	70.3	183,034,203	59.4	108,661,801	51	60	64	88	803,111	3,002,578
1894	2,737,973	62.4	170,787,338	53.6	91,526,787	43	58	40	70	572,957	1,341,533
1895	2,954,952	100.6	297,237,370	26.6	78,984,901	18	24	10	23	680,049	175,240
1896	2,767,465	91.1	252,234,540	28.6	72,182,350	18	26	19	26	926,646	246,178
1897	2,534,577	64.7	164,015,964	54.7	89,643,059	50	62	60	87	605,187	1,171,378
1898	2,557,729	75.2	192,306,338	41.4	79,574,772	30	36	33	52	579,833	530,420
1899	2,581,353	88.6	228,783,232	39.0	89,328,832	35	46	27	39	809,472	155,861
1900	2,611,054	80.8	210,926,897	43.1	90,811,167	40	48	35	60	741,483	371,911
1901	2,864,335	65.5	187,598,087	76.7	143,979,470	75	82	58	100	528,484	7,656,162
1902	2,965,587	96.0	284,632,787	47.1	134,111,436	42	48	42	60	843,075	358,505
1903	2,916,855	84.7	247,127,880	61.4	151,638,094	60	66	95	116	484,042	3,166,581
1904	3,015,675	110.4	332,830,300	45.3	150,673,392	32	38	20	25	1,163,270	181,199
1905	2,996,757	87.0	260,741,294	61.7	160,821,080	55	66	48	73	1,000,326	1,948,160
1906	3,013,150	102.2	308,038,382	51.1	157,547,392	40	43	55	75	1,530,461	176,917
1907	3,128,000	95.4	298,262,000	61.8	184,184,000	46	58	[b] 50	[b] 80	1,203,894	403,952
1908	3,257,000	85.7	278,985,000	70.6	197,039,000	[b] 60	[b] 77	......	......	....	....

[a] Census figures of production. [b] White stock.

Average yield of potatoes in certain countries, bushels per acre, 1898–1907.

Year.	United States.[a]	Russia, European.[b]	Germany.[b]	Austria.[b]	Hungary proper.[b]	France.[a]	United Kingdom.[a]
1898	75.2	100.7	177.2	158.5	121.0	114.0	195.2
1899	88.6	102.0	182.7	163.1	117.4	117.2	179.9
1900	80.8	104.7	187.5	149.0	131.6	126.0	140.7
1901	65.5	92.2	218.1	155.8	126.8	115.6	216.9
1902	96.0	107.5	199.4	152.4	113.3	114.1	183.7
1903	84.7	91.1	197.0	126.2	125.0	120.2	106.1
1904	110.4	88.4	164.2	126.1	86.2	123.4	195.6
1905	87.0	106.6	216.7	182.5	126.8	142.5	218.8
1906	102.2	94.9	193.3	158.4	128.7	99.5	192.2
1907	95.4	102.4	205.3	173.2	57.0	107.7	171.0
Average 1898 to 1907	88.6	99.0	194.1	154.5	113.3	118.0	186.0

[a] Winchester bushels. [b] Bushels of 60 pounds.

Average yield per acre of potatoes in the United States.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Maine	119	119	110	143	139	126	150	130	196	215	175	210	145	225
New Hampshire	124	124	97	106	127	101	108	120	98	135	120	112	120	100
Vermont	141	141	99	112	132	134	90	94	138	128	98	101	120	73
Massachusetts	116	116	98	98	134	79	77	109	96	119	97	114	120	95
Rhode Island	96	96	102	122	142	94	98	164	125	137	125	108	110	150
Connecticut	99	99	83	94	130	96	81	92	96	96	92	98	100	80
New York	101	101	76	79	88	81	78	66	89	93	70	105	98	82
New Jersey	81	78	77	89	83	69	59	132	99	115	93	120	120	72
Pennsylvania	94	75	73	80	85	58	62	83	91	106	90	94	88	72
Delaware	77	71	61	68	52	48	55	79	84	84	93	97	99	82
Maryland	71	71	68	74	64	55	60	80	70	99	95	93	95	77
Virginia	69	67	67	74	66	58	71	75	84	83	84	75	80	88
West Virginia	78	71	68	78	72	80	52	96	80	101	88	97	83	84
North Carolina	87	72	69	68	57	61	64	64	67	78	77	75	88	79
South Carolina	78	67	68	71	56	78	70	69	81	88	83	82	70	81
Georgia	81	62	65	60	46	68	64	58	73	70	65	77	83	78
Florida	111	69	73	75	69	60	62	90	82	102	75	85	80	83
Ohio	85	74	65	75	71	76	54	94	83	98	78	110	76	77
Indiana	77	69	62	73	76	83	31	101	76	93	80	89	87	57
Illinois	76	79	63	80	96	92	35	118	72	108	75	97	87	71
Michigan	97	85	71	82	66	97	81	72	78	121	67	95	90	72
Wisconsin	89	85	75	92	103	103	75	115	58	126	68	97	91	80
Minnesota	105	100	85	87	96	81	68	98	64	102	82	92	101	76
Iowa	96	88	69	81	100	72	32	98	56	136	80	95	85	80
Missouri	82	78	71	75	82	93	17	128	66	96	82	84	82	80
North Dakota	.....	.....	80	95	103	52	110	105	84	111	95	98	89	85
South Dakota	.....	.....	57	81	78	73	45	74	89	96	98	100	84	90
Nebraska	87	84	60	83	94	66	33	137	64	120	93	87	73	78
Kansas	95	76	59	74	95	72	26	138	58	80	81	79	65	80
Kentucky	70	69	63	67	51	70	35	80	73	83	85	82	80	62
Tennessee	71	72	64	58	44	54	46	62	66	71	80	80	85	80
Alabama	72	71	65	64	56	69	67	50	67	61	80	75	95	85
Mississippi	78	70	66	74	61	66	62	69	82	82	110	85	90	91
Louisiana	85	63	67	64	60	70	60	65	50	70	64	62	67	82
Texas	104	70	66	64	64	62	54	66	67	72	64	77	73	71
Oklahoma	.....	.....	.....	75	78	82	59	91	74	77	76	80	70	78
Arkansas	83	81	71	65	63	72	46	72	70	77	65	80	70	82
Montana	.....	103	102	145	141	134	157	153	176	143	120	152	150	138
Wyoming	.....	94	102	138	125	99	113	100	167	161	170	115	200	158
Colorado	.....	79	91	109	84	56	120	100	145	159	160	125	150	125
New Mexico	.....	75	75	63	49	19	50	72	87	62	75	121	100	100
Utah	.....	96	96	139	120	118	114	157	177	137	132	165	100	160
Nevada	104	97	107	146	102	156	141	212	117	131	120	175	200	120
Idaho	.....	98	110	138	124	136	108	149	160	139	140	175	145	130
Washington	.....	120	120	132	144	116	117	136	145	120	142	129	150	120
Oregon	111	115	91	106	115	110	90	103	107	87	110	101	125	99
California	116	101	81	115	119	104	101	118	130	129	165	125	145	107
United States	92.9	81.2	73.2	84.4	88.6	80.8	65.5	96.0	84.7	110.4	87.0	102.2	95.4	85.7
Division:[a]														
N. Atlantic	105.3	100.1	81.5	88.3	96.8	80.2	80.1	85.4	103.0	112.4	91.8	115.2	104.3	95.8
S. Atlantic	75.0	69.4	67.4	72.8	64.5	64.8	63.1	77.6	77.3	88.7	84.8	84.1	84.9	82.7
N. Central E. of Miss. R.	85.2	78.8	67.0	82.4	82.5	90.6	62.7	97.7	72.2	113.6	71.9	98.0	87.2	73.4
N. Central W. of Miss. R.	92.7	87.1	69.4	81.3	93.6	74.5	40.4	111.8	63.6	110.5	84.3	89.7	83.9	79.7
S. Central	73.6	70.8	64.8	65.4	54.9	66.2	48.5	71.9	69.3	75.3	75.3	78.4	77.1	75.5
Far Western	114.5	103.8	93.3	119.1	112.3	95.7	110.5	120.4	139.4	130.0	143.3	128.4	143.0	119.7

[a] See note *a*, page 599.

Average farm value per acre of potatoes in the United States December 1.

State, Territory, or Division.	10-year averages. 1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	59.50	53.90	60.50	80.08	58.38	61.74	100.50	84.50	109.76	103.20	106.75	105.00	81.20	137.25
N. Hampshire	63.24	53.20	56.26	66.78	58.42	53.53	85.32	82.80	63.70	75.60	86.40	67.20	80.42	73.00
Vermont	54.99	55.00	48.51	58.24	47.52	53.60	57.60	54.52	69.00	60.16	69.58	55.55	63.62	48.93
Massachusetts	75.40	66.50	67.62	71.54	76.38	52.14	69.30	88.29	68.16	84.49	81.48	74.10	100.80	80.75
Rhode Island	67.20	65.12	71.40	91.50	71.00	65.80	91.14	123.00	102.50	104.12	111.25	86.40	102.33	129.00
Connecticut	66.33	56.16	55.61	67.68	59.80	67.20	76.14	67.16	74.88	69.12	83.72	70.56	77.00	72.00
New York	50.50	42.66	37.24	42.66	35.20	36.45	55.38	38.94	49.84	50.22	49.00	51.45	55.86	61.50
New Jersey	55.08	54.60	46.97	56.96	42.33	41.40	50.15	80.52	68.31	70.15	69.75	79.20	88.80	64.08
Pennsylvania	55.46	42.00	39.42	44.80	36.55	30.74	47.12	47.31	56.42	57.24	58.50	53.58	58.96	57.60
Delaware	51.59	45.44	32.94	39.44	26.52	28.80	42.90	40.29	47.04	44.52	54.87	57.23	64.38	68.00
Maryland	46.86	44.73	36.04	40.70	32.64	29.70	46.20	41.60	42.00	50.49	55.10	52.08	57.00	56.97
Virginia	38.64	38.19	35.51	42.92	36.96	34.22	52.54	43.50	53.76	45.65	47.04	50.25	54.39	63.37
W. Virginia	43.68	36.92	37.40	44.46	37.44	40.80	44.20	48.96	52.80	54.54	51.04	59.17	66.41	71.41
N. Carolina	52.20	46.80	41.40	44.20	37.62	39.65	46.08	42.88	49.58	54.60	52.36	55.50	68.65	60.84
S. Carolina	73.32	53.60	55.08	70.29	58.24	78.00	77.00	66.24	84.24	88.88	85.49	86.10	77.00	89.11
Georgia	80.19	55.80	54.60	54.60	38.18	52.36	67.84	52.20	68.62	74.90	72.80	84.70	83.00	85.80
Florida	125.43	62.10	67.16	88.50	85.56	63.60	79.98	109.80	103.32	131.58	90.00	93.50	76.00	112.00
Ohio	51.00	39.22	35.10	38.25	30.53	30.40	45.90	41.36	50.63	46.06	49.14	52.80	51.68	59.29
Indiana	44.66	34.50	34.72	37.23	32.68	31.54	27.90	41.41	50.16	41.85	46.40	50.73	56.55	47.88
Illinois	45.60	41.08	36.54	43.20	39.36	37.72	32.55	49.56	51.84	50.76	50.25	60.14	62.64	58.93
Michigan	48.50	38.25	29.82	31.98	21.12	25.22	55.08	29.52	38.22	35.09	37.52	32.30	40.50	41.76
Wisconsin	43.61	35.70	33.00	34.96	26.78	28.84	50.25	37.95	33.64	35.28	42.16	29.10	40.95	48.00
Minnesota	51.45	36.00	33.15	32.19	24.00	24.30	45.56	30.38	39.04	29.58	41.00	34.04	41.41	42.56
Iowa	43.20	38.72	33.12	35.64	23.00	26.64	30.08	33.32	42.00	38.08	39.20	40.85	46.75	48.00
Missouri	46.74	37.44	34.79	39.75	33.20	32.55	18.02	44.80	50.16	46.08	45.10	47.88	59.03	59.20
N. Dakota	......	......	32.00	34.20	27.81	25.48	53.90	34.65	40.32	35.52	36.10	45.08	55.19	47.60
S. Dakota	......	......	27.93	31.59	21.06	26.28	38.25	32.56	48.06	28.80	36.48	35.00	42.00	45.91
Nebraska	54.81	34.44	32.40	39.01	23.50	32.34	34.65	36.99	41.60	31.20	34.41	45.24	51.10	42.90
Kansas	61.75	48.64	37.17	42.92	42.75	34.56	27.04	62.10	49.30	44.80	55.89	55.30	57.20	66.40
Kentucky	40.60	34.50	35.28	38.19	31.11	35.00	30.45	42.40	49.64	45.65	45.05	50.02	60.00	50.21
Tennessee	41.18	36.72	33.28	36.54	28.60	31.32	39.56	39.68	42.24	44.02	46.40	49.60	64.59	56.79
Alabama	72.72	63.19	53.95	58.24	48.72	56.58	73.03	46.50	64.32	60.39	70.40	69.75	95.00	89.73
Mississippi	71.76	60.90	52.80	64.38	62.22	54.78	71.30	63.48	72.16	69.70	93.50	73.95	83.67	84.62
Louisiana	79.90	53.55	54.94	54.40	48.60	55.30	60.60	53.30	45.50	63.70	58.24	46.50	60.33	75.46
Texas	122.72	67.90	57.42	58.88	58.24	54.56	67.50	56.10	58.96	66.96	59.52	66.99	76.64	69.58
Oklahoma	......	......	......	67.50	55.38	53.30	73.81	65.23	68.79	58.70	64.86	62.08	70.00	76.44
Arkansas	70.55	59.13	44.02	48.10	44.73	41.04	57.96	48.96	55.30	57.75	47.45	53.60	63.68	70.53
Montana	......	71.07	63.24	75.40	74.73	71.02	114.61	76.50	77.44	87.23	70.80	92.72	75.00	96.60
Wyoming	......	69.56	62.22	86.94	76.25	67.32	112.40	65.27	95.19	99.82	95.20	74.75	148.00	104.33
Colorado	......	65.57	46.41	64.31	46.20	45.92	108.00	51.00	87.00	58.83	91.20	56.25	99.00	75.00
N. Mexico	......	63.00	53.25	54.18	33.32	21.66	59.00	58.32	73.08	48.36	66.75	108.90	96.00	90.00
Utah	......	46.08	42.24	61.16	66.00	56.64	68.40	70.65	83.19	65.76	56.76	82.50	65.00	88.00
Nevada	186.16	92.15	60.99	105.12	91.80	87.36	128.31	133.56	81.90	85.15	98.40	122.50	180.00	90.00
Idaho	......	68.60	58.30	69.00	75.64	63.92	90.72	55.13	73.60	87.57	67.20	71.75	75.43	78.00
Washington	......	60.00	52.80	58.08	72.00	54.52	71.37	51.68	52.20	67.20	65.32	72.24	75.00	80.39
Oregon	75.48	60.95	43.68	54.06	56.35	49.50	63.00	56.65	53.50	51.33	66.00	56.56	70.00	67.83
California	111.36	72.72	45.36	70.15	74.97	55.12	77.77	68.44	85.80	86.43	110.55	92.50	130.50	82.39
United States	51.00	42.95	37.19	42.12	34.61	34.78	50.27	45.22	51.99	49.96	53.67	52.29	58.86	60.50
Division: [a]														
N. Atlantic	56.44	56.66	43.44	50.07	41.52	40.01	58.90	52.42	61.33	61.23	62.97	62.01	64.98	70.60
S. Atlantic	46.95	41.99	38.62	46.37	37.39	38.36	51.27	47.11	54.08	54.97	54.65	57.99	62.57	67.48
N. Central E. of Miss. River	47.54	38.38	34.14	36.34	29.82	30.68	46.11	38.24	42.35	40.29	43.94	41.08	47.52	49.62
N. Central W. of Miss. River	48.95	39.28	34.21	36.83	27.37	29.30	33.08	38.53	43.58	36.45	41.36	42.89	49.42	49.89
S. Central	49.24	42.62	39.72	48.33	39.91	40.95	52.40	49.68	54.83	55.73	55.43	57.22	69.54	67.12
Far Western	108.78	68.61	48.52	64.31	63.22	53.34	84.78	60.17	74.42	69.46	82.56	73.42	93.09	79.48

[a] See note *a*, page 599.

Average farm price of potatoes per bushel in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts*	*Cts*	*Cts.*	*Cts.*	*Cts*	*Cts.*	*Cts.*	*Cts*	*Cts.*	*Cts.*
Maine	50	55	55	56	42	49	67	65	56	48	61	50	56	61	58	70	72	72	75	56
New Hampshire	51	56	58	63	46	53	79	69	65	56	72	60	67	73	70	74	81	81	92	71
Vermont	39	50	49	52	36	40	64	58	50	47	71	55	53	67	55	64	70	74	89	67
Massachusetts	65	70	69	73	57	60	90	81	71	71	84	65	84	85	85	91	98	97	92	84
Rhode Island	70	74	70	75	50	70	93	75	82	76	89	80	93	86	90	95	98	110	88	90
Connecticut	67	72	67	72	46	70	94	73	78	72	91	72	77	90	80	96	95	95	94	92
New York	50	54	49	54	40	45	71	59	56	54	70	49	57	75	58	71	81	74	93	67
New Jersey	68	70	61	64	51	60	85	61	69	61	75	66	74	89	74	79	86	82	87	91
Pennsylvania	59	56	54	56	43	53	76	57	62	54	65	57	67	80	74	71	74	76	84	79
Delaware	67	64	54	58	51	60	78	51	56	53	59	59	65	83	70	63	70	75	74	83
Maryland	66	63	53	55	51	54	77	52	60	51	58	56	60	74	60	65	70	70	72	70
Virginia	56	57	53	58	56	59	74	58	64	55	56	67	68	72	69	77	80	71	65	67
West Virginia	56	52	55	57	52	51	85	51	66	54	58	61	80	85	82	87	90	90	76	78
North Carolina	60	65	60	65	66	65	72	67	74	70	68	74	78	77	81	89	97	80	76	76
South Carolina	94	80	81	99	104	100	110	96	104	101	103	105	110	110	111	135	125	115	105	110
Georgia	99	90	84	91	83	77	106	90	94	107	112	110	100	110	115	123	125	110	115	100
Florida	113	90	92	118	124	106	129	122	126	129	120	110	95	135	......	156	......	120	......	131
Ohio	60	53	54	51	43	40	85	44	61	47	63	48	68	77	68	72	77	91	81	78
Indiana	58	50	56	51	43	38	90	41	66	45	58	57	65	84	65	68	75	89	92	83
Illinois	60	52	58	54	41	41	93	42	72	47	67	62	72	83	73	75	81	103	88	85
Michigan	50	45	42	39	32	26	68	41	49	29	56	34	45	58	45	52	57	69	71	55
Wisconsin	49	42	44	38	26	28	67	33	58	28	62	30	45	60	48	51	62	71	70	59
Minnesota	49	36	39	37	25	30	67	31	61	29	50	37	41	56	45	50	50	55	53	54
Iowa	45	44	48	44	23	37	94	34	75	28	49	43	55	60	60	63	66	70	63	57
Missouri	57	48	49	53	40	35	106	35	76	43	55	57	72	74	76	80	81	89	67	71
North Dakota	......	......	40	36	27	49	49	33	48	32	38	46	62	56	65	68	71	73	67	58
South Dakota	......	......	49	39	27	36	85	44	54	30	38	35	50	51	58	62	62	61	54	47
Nebraska	63	41	54	47	25	49	105	27	65	26	37	52	70	55	71	69	69	79	62	53
Kansas	65	64	63	58	45	48	104	45	85	56	69	70	88	83	88	94	97	110	89	85
Kentucky	58	50	56	57	61	50	87	53	68	55	53	61	75	81	73	80	89	89	77	81

Tennessee	58	51	52	63	65	58	86	64	64	62	58	62	76	71	78	86	96	77	65	66
Alabama	101	89	83	91	87	82	109	93	96	99	88	93	100	95	100	111	123	92	95	98
Mississippi	92	87	80	87	102	83	115	92	88	85	85	87	93	93	100	119	112	90	90	100
Louisiana	94	85	82	85	81	79	101	82	91	91	91	75	90	92	100	117	101	75	83	95
Texas	118	97	87	92	91	88	125	85	88	93	93	87	105	98	110	113	115	90	94	95
Oklahoma	......	......	......	90	71	65	125	71	93	76	85	77	100	98	100	107	110	98	93	105
Arkansas	85	73	62	74	71	57	126	68	79	75	73	67	91	86	98	104	106	74	75	81
Montana	......	69	62	52	53	53	73	50	44	61	59	61	50	70	50	56	60	65	102	68
Wyoming	......	74	61	63	61	68	100	61	57	62	56	65	74	66	86	82	75	90	92	63
Colorado	......	83	51	59	55	82	90	51	60	37	57	45	66	60	70	67	73	85	80	60
New Mexico	......	84	71	86	68	114	118	81	84	78	89	90	96	90	92	97	97	100	109	91
Utah	......	48	44	44	55	48	60	45	47	48	43	50	65	55	65	63	68	72	68	55
Nevada	179	95	57	72	90	56	91	63	70	65	82	70	90	75	65	112	80	101	90	85
Idaho	......	70	53	50	61	47	84	37	46	63	48	41	52	60	46	58	52	60	65	62
Washington	......	50	44	44	50	47	61	38	36	56	46	56	50	67	47	48	41	48	70	70
Oregon	68	53	48	51	49	45	70	55	50	59	60	56	56	68	47	50	50	54	65	70
California	96	72	56	61	63	53	77	58	66	67	67	74	90	77	86	81	75	81	74	74
United States	54.9	52.9	50.8	49.9	39.0	43.1	76.7	47.1	61.4	45.3	61.7	51.1	61.8	70.6	63.4	69.0	73.3	77.8	78.0	69.2
Division: *a*																				
North Atlantic	53.6	56.6	53.3	56.7	42.9	49.9	73.6	61.4	59.6	54.5	68.6	53.8	62.3	73.7	64.9	73.0	79.2	76.4	87.8	71.9
South Atlantic	62.6	60.5	57.3	63.7	57.9	59.2	81.2	60.7	69.9	62.0	64.5	69.0	73.7	81.6	76.0	84.2	86.4	80.6	75.3	76.5
North Central East of Mississippi River	55.8	48.7	50.5	44.1	36.2	33.9	73.5	39.1	58.7	35.5	61.1	41.9	54.5	67.6	55.5	59.7	66.8	80.6	77.0	67.3
North Central West of Mississippi River	52.8	45.1	49.3	45.3	29.2	39.3	81.8	34.5	68.6	33.0	49.1	47.8	58.9	62.6	62.5	66.0	67.3	75.9	64.3	61.1
South Central	66.9	60.2	61.3	73.9	72.7	61.9	108.1	69.1	79.2	74.0	73.6	73.0	90.2	88.9	92.7	100.5	104.8	86.0	82.6	88.2
Far Western	95.0	66.1	52.0	54.0	56.3	55.8	76.7	50.0	53.4	53.4	57.6	57.2	65.1	66.4	62.7	64.1	61.6	68.7	75.2	67.8

a See note *a*, page 599.

Wholesale prices of potatoes per bushel, 1895–1908.

Date.	Chicago.		Milwaukee.		St. Louis.		Cincinnati.	
	Burbank, per bushel.		Per bushel.		Burbank, per bushel.		Per barrel [a].	
	Low.	High.	Low.	High.	Low.	High.	Low.	High
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*		
1895	17	75	15	100	20	82	......	......
1896	10	31	10	35	20	45	$0.60	$1.35
1897	18	62	15	100	21	65	.90	4.75
1898	29	87	25	90	30	85	1.25	3.75
1899	26	75	15	90	25	75	1.10	6.00
1900	25	50	20	80	27	54	.32	.57
1901	30	125	25	185	18	140	.30	1.20
1902	30	100	......	......	41	105	.90	3.00
1903	38	85	35	90	40	125	1.20	3.00
1904	31	122	20	120	36	125	1.20	4.80
1905.							Per bushel.	
January	32	38	22	32	35	42	.38	.42
February	33	37	22	32	40	50	.35	.43
March	25	37	20	30	31	38	.25	.40
April	20	29	18	25	27	40	.25	.32
May	20	25	15	26	65	175	.25	.30
June	18	25	10	21	35	70	.25	.60
July	......	......	10	52	35	45	.45	.55
August	......	......	35	55	30	48	.45	.50
September	43	48	35	50	40	60	.45	.55
October	43	72	38	65	52	73	.50	.75
November	64	70	50	70	62	80	.60	.75
December	55	66	40	62	58	66	.55	.80
1906.								
January	55	66	45	58	58	82	.55	.65
February	47	57	35	50	53	61	.45	.62
March	43	68	35	62	51	70	.45	.75
April	57	63	50	62	65	68	.60	.85
May	48	73	45	75	60	88	.55	.75
June	60	87	50	80	65	125	.90	1.05
July	......	......	40	87	35	75	.75	.90
August	......	......	35	50	37	60	.58	.80
September	45	58	35	55	43	62	.55	.60
October	40	47	25	40	48	56	.50	.60
November	41	48	25	40	45	55	.45	.58
December	[b] 40	[b] 43	25	40	40	46	.45	.47
1907.								
January	34	45	25	45	43	53	.45	.50
February	37	48	25	45	51	56	.48	.53
March	33	47	25	45	43	55	.50	.53
April	33	61	25	60	63	68	.40	.80
May	55	75	40	70	74	75	.70	.80
June	32	70	30	70	60	78	.60	.70
July	30	50	35	90	50	125	.25	.85
August	......	......	30	90	60	95	.70	.80
September	50	60	45	75	45	72	.60	.85
October	45	65	40	75	55	70	.50	.62
November	45	63	40	65	53	65	.50	.65
December	46	58	40	65	55	64	.50	.65
1908.								
January	52	65	53	75	62	69	.60	.68
February	58	73	65	70	67	77	.65	.82
March	62	75	63	70	71	78	.70	.80
April	60	77	65	80	73	78	.70	.85
May	50	80	58	80	65	74	.60	.85
June	53	150	58	150	100	105	.60	1.35
July	70	110	55	110	......	......	1.10	1.35
August	58	90	60	85	......	......	.85	1.15
September	58	78	60	80	72	72	.75	.85
October	50	81	54	80	67	70	.65	.80
November	57	71	58	70	69	72	.65	.75
December	60	77	64	70	69	75	.65	.80

[a] Per bushel for 1900 and 1901.

[b] Common to fancy.

HAY.

Acreage, production, value, prices, and exports of hay in the United States, 1849–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per ton Dec. 1.	Farm value Dec. 1.	Chicago prices No. 1 timothy per ton, by carload lots.				Domestic exports, fiscal year beginning July 1.
						December.		May of following year.		
						Low.	High.	Low.	High.	
	Acres.	*Tons.*[a]	*Tons.*[a]	*Dolls.*	*Dollars.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Tons.*[b]
1849[c]			13,838,642							
1859[c]			19,083,896							
1866	17,668,904	1.23	21,778,627	10.14	220,835,771					5,028
1867	20,020,554	1.31	26,277,000	10.21	268,300,623					5,645
1868	21,541,573	1.21	26,141,900	10.08	263,589,235					
1869	18,591,281	1.42	26,420,000	10.18	268,933,048					6,723
1870	19,861,805	1.23	24,525,000	12.47	305,743,224					4,581
1871	19,099,052	1.17	22,239,400	14.30	317,939,799					5,266
1872	20,318,936	1.17	23,812,800	12.94	308,024,517					4,557
1873	21,894,084	1.15	25,085,100	12.53	314,241,037					4,889
1874	21,769,772	1.15	25,133,900	11.94	300,222,454					7,183
1875	23,507,964	1.19	27,873,600	10.78	300,377,839					7,528
1876	25,282,797	1.22	30,867,100	8.97	276,991,422			9.00	10.00	7,287
1877	25,367,708	1.25	31,629,300	8.37	264,879,796	9.50	10.50	9.75	10.75	9,514
1878	26,931,300	1.47	39,608,296	7.20	285,015,625	8.00	8.50	9.00	11.50	8,127
1879	27,484,991	1.29	35,493,000	9.32	330,804,494	14.00	14.50	14.00	15.00	13,739
1880	25,863,955	1.23	31,925,233	11.65	371,811,084	15.00	15.50	17.00	19.00	12,662
1881	30,888,700	1.14	35,135,064	11.82	415,131,366	16.00	16.50	15.00	16.50	10,570
1882	32,339,585	1.18	38,138,049	9.70	371,170,326	11.50	12.25	12.00	13.00	13,309
1883	35,515,948	1.32	46,864,009	8.19	383,834,451	9.00	10.00	12.50	17.00	16,908
1884	38,571,593	1.26	48,470,460	8.17	396,139,309	10.00	11.50	15.50	17.50	11,142
1885	39,849,701	1.12	44,731,550	8.71	389,752,873	11.00	12.00	10.00	12.00	13,390
1886	36,501,688	1.15	41,796,499	8.46	353,437,699	9.50	10.50	11.00	12.50	13,873
1887	37,664,739	1.10	41,454,458	9.97	413,440,283	13.50	14.50	17.00	21.00	18,198
1888	38,591,903	1.21	46,643,094	8.76	408,499,565	11.00	11.50	10.50	11.00	21,928
1889	52,947,236	1.26	66,829,612	7.04	470,374,948	9.00	10.00	9.00	14.00	36,274
1890	50,712,513	1.19	60,197,589	7.87	473,569,972	9.00	10.50	12.50	15.50	28,066
1891	51,044,490	1.19	60,817,771	8.12	494,113,616	12.50	15.00	13.50	14.00	35,201
1892	50,853,061	1.18	59,823,735	8.20	490,427,798	11.00	11.50	12.00	13.50	33,084
1893	49,613,469	1.33	65,766,158	8.68	570,882,872	10.00	10.50	10.00	10.50	54,446
1894	48,321,272	1.14	54,874,408	8.54	468,578,321	10.00	11.00	10.00	10.25	47,117
1895	44,206,453	1.06	47,078,541	8.35	393,185,615	12.00	12.50	11.50	12.00	59,052
1896	43,259,756	1.37	59,282,158	6.55	388,145,614	8.00	8.50	8.50	9.00	61,658
1897	42,426,770	1.43	60,664,876	6.62	401,390,728	8.00	8.50	9.50	10.50	81,827
1898	42,780,827	1.55	66,376,920	6.00	398,060,647	8.00	8.25	9.50	10.50	64,916
1899	41,328,462	1.35	56,655,756	7.27	411,926,187	10.50	11.50	10.50	12.50	72,716
1900	39,132,890	1.28	50,110,906	8.89	445,538,870	11.50	14.00	12.50	13.50	89,364
1901	39,390,508	1.28	50,590,877	10.01	506,191,533	13.00	13.50	12.50	13.50	153,431
1902	39,825,227	1.50	59,857,576	9.06	542,036,364	12.00	12.50	13.50	15.00	50,970
1903	39,933,759	1.54	61,305,940	9.08	556,376,880	10.00	12.00	12.00	15.00	60,730
1904	39,998,602	1.52	60,696,028	8.72	529,107,625	10.50	11.50	11.00	12.00	66,557
1905	39,361,960	1.54	60,531,611	8.52	515,959,784	10.00	12.00	11.50	12.50	70,172
1906	42,476,224	1.35	57,145,959	10.37	592,539,671	15.50	18.00	15.50	20.50	58,602
1907	44,028,000	1.45	63,677,000	11.68	743,507,000	13.00	17.50	13.00	14.00	77,281
1908	46,486,000	1.52	70,798,000	8.98	635,423,000	11.50	12.00			

[a] 2,000 pounds. [b] 2,240 pounds. [c] Census figures.

Acreage, production, and value of hay in the United States, 1908.

State, Territory, or Division.	Acreage.	Production.	Farm value December 1.
	Acres.	*Tons.*	*Dollars.*
Maine	1,400,000	1,260,000	17,640,000
N. Hampshire	640,000	589,000	9,424,000
Vermont	870,000	966,000	13,041,000
Massachusetts	585,000	702,000	11,934,000
Rhode Island	60,000	90,000	1,552,000
Connecticut	490,000	588,000	9,261,000
New York	4,764,000	5,717,000	70,033,000
New Jersey	437,000	699,000	9,786,000
Pennsylvania	3,118,000	4,677,000	56,124,000
Delaware	78,000	125,000	1,562,000
Maryland	300,000	480,000	5,760,000
Virginia	475,000	618,000	7,570,000
W. Virginia	620,000	899,000	9,889,000
N. Carolina	175,000	262,000	3,537,000
S. Carolina	65,000	81,000	1,199,000
Georgia	87,000	152,000	2,181,000
Florida	19,000	26,000	385,000
Ohio	3,000,000	4,590,000	39,933,000
Indiana	2,500,000	3,750,000	33,000,000
Illinois	3,100,000	4,743,000	38,893,000
Michigan	2,727,000	3,954,000	34,598,000
Wisconsin	2,346,000	3,988,000	31,904,000
Minnesota	909,000	1,527,000	8,246,000
Iowa	3,800,000	6,460,000	36,822,000
Missouri	2,900,000	4,350,000	30,450,000
N. Dakota	187,000	243,000	1,166,000
S. Dakota	510,000	765,000	3,136,000
Nebraska	1,515,000	2,348,000	11,505,000
Kansas	1,829,000	2,744,000	15,641,000
Kentucky	500,000	675,000	7,425,000
Tennessee	400,000	600,000	7,080,000
Alabama	110,000	176,000	2,200,000
Mississippi	81,000	122,000	1,342,000
Louisiana	22,000	31,000	341,000
Texas	650,000	1,072,000	8,844,000
Oklahoma	900,000	1,305,000	6,525,000
Arkansas	198,000	297,000	2,806,000
Montana	525,000	1,050,000	8,768,000
Wyoming	252,000	504,000	3,730,000
Colorado	670,000	1,675,000	14,656,000
New Mexico	168,000	336,000	3,192,000
Arizona	103,000	330,000	4,026,000
Utah	375,000	938,000	6,941,000
Nevada	200,000	400,000	3,520,000
Idaho	434,000	1,410,000	10,011,000
Washington	373,000	839,000	9,229,000
Oregon	414,000	828,000	7,700,000
California	605,000	817,000	10,825,000
United States	46,486,000	70,798,000	635,423,000
Division:[a]			
N. Atlantic	12,364,000	15,288,000	198,795,000
S. Atlantic	1,819,000	2,643,000	32,083,000
N. Central E. of Miss. R	13,673,000	21,025,000	178,328,000
N. Central W. of Miss. R	11,650,000	18,437,000	106,966,000
S. Central	2,861,000	4,278,000	36,653,000
Far Western	4,119,000	9,127,000	82,598,000

[a] See note *a*, page 599.

Average yield per acre of hay in the United States.

State, Territory, or Division.	10-year averages				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Maine	0.87	0.98	0.96	1.04	0.90	0.90	1.05	1.07	0.98	1.10	1.68	1.20	1.50	0.90
N. Hampshire	1.00	.96	.97	1.06	.89	.87	1.28	1.66	.92	1.02	1.16	1.15	1.35	.92
Vermont	1.05	1.06	1.14	1.28	1.14	1.24	1.36	1.27	1.18	1.25	1.35	1.20	1.60	1.11
Massachusetts	1.10	1.14	1.13	1.29	1.13	.97	1.21	1.60	1.36	1.23	1.33	1.31	1.30	1.20
Rhode Island	1.04	1.04	.94	1.05	.89	.92	.92	1.03	1.07	1.16	1.69	1.66	1.35	1.50
Connecticut	1.23	1.09	1.01	1.11	.94	.89	1.01	1.35	1.11	1.06	1.12	1.17	1.30	1.20
New York	1.21	1.16	1.12	1.20	1.04	.81	1.30	1.34	1.26	1.36	1.30	1.28	1.25	1.20
New Jersey	1.27	1.16	1.17	1.28	.83	1.26	1.32	1.22	1.28	1.39	1.13	1.32	1.45	1.60
Pennsylvania	1.19	1.21	1.15	1.28	1.20	1.10	1.19	1.19	1.27	1.45	1.50	1.30	1.45	1.50
Delaware	1.13	1.01	1.13	1.28	1.04	.98	1.12	1.09	1.64	1.59	1.55	1.25	1.40	1.60
Maryland	1.12	1.10	1.15	1.18	1.13	1.09	1.22	1.01	1.24	1.36	1.30	1.26	1.40	1.60
Virginia	1.19	1.19	1.06	1.20	1.10	1.16	1.20	1.06	1.30	1.39	1.30	1.25	1.40	1.30
W. Virginia	1.16	1.16	1.00	1.34	1.29	1.18	1.37	1.12	1.38	1.47	1.48	1.40	1.45	1.45
N. Carolina	1.29	1.27	1.27	1.51	1.50	1.41	1.66	1.44	1.60	1.72	1.60	1.54	1.50	1.50
S. Carolina	.99	1.17	1.21	1.36	1.22	1.32	1.46	1.22	1.46	1.53	1.42	1.46	1.50	1.25
Georgia	1.25	1.37	1.25	1.50	1.45	1.69	1.46	1.36	1.53	1.52	1.50	1.65	1.75	1.75
Florida	......	......	1.38	1.37	1.46	1.20	1.48	1.24	1.47	1.36	1.48	1.50	1.35	1.35
Ohio	1.20	1.24	1.17	1.36	1.30	1.06	1.36	1.43	1.42	1.43	1.49	1.22	1.45	1.53
Indiana	1.28	1.32	1.17	1.38	1.34	1.21	1.27	1.46	1.47	1.37	1.48	1.10	1.35	1.50
Illinois	1.36	1.38	1.17	1.36	1.29	1.27	1.08	1.50	1.54	1.36	1.35	.98	1.40	1.53
Michigan	1.22	1.29	1.15	1.33	1.22	1.29	1.26	1.45	1.37	1.25	1.46	1.28	1.25	1.45
Wisconsin	1.34	1.31	1.18	1.53	1.47	1.15	1.29	1.90	1.89	1.67	1.80	1.35	1.35	1.70
Minnesota	1.32	1.41	1.26	1.66	1.70	1.16	1.55	1.76	1.84	1.74	1.75	1.70	1.70	1.68
Iowa	1.53	1.38	1.19	1.58	1.34	1.42	1.25	1.68	1.78	1.62	1.70	1.35	1.40	1.70
Missouri	1.46	1.28	1.15	1.33	1.37	1.29	.75	1.59	1.57	1.47	1.10	.78	1.40	1.50
N. Dakota	......	......	1.17	1.48	1.58	.92	1.60	1.66	1.18	1.57	1.55	1.45	1.30	1.30
S. Dakota	......	......	1.07	1.34	1.43	1.18	1.15	1.23	1.45	1.43	1.60	1.50	1.40	1.50
Nebraska	1.56	1.45	1.13	1.61	1.66	1.38	1.25	1.74	1.68	1.76	1.75	1.40	1.50	1.55
Kansas	1.54	1.38	1.16	1.45	1.57	1.32	.91	1.70	1.58	1.67	1.55	1.28	1.15	1.50
Kentucky	1.26	1.27	1.17	1.35	1.29	1.40	1.34	1.44	1.46	1.44	1.30	1.35	1.35	1.35
Tennessee	1.32	1.27	1.22	1.49	1.31	1.40	1.52	1.44	1.58	1.66	1.60	1.51	1.50	1.50
Alabama	1.22	1.34	1.44	1.69	1.66	1.85	1.75	1.50	1.77	1.71	1.90	1.95	1.80	1.60
Mississippi	1.27	1.36	1.44	1.62	1.44	1.75	1.69	1.40	1.74	1.72	1.75	1.90	1.60	1.50
Louisiana	1.45	1.17	1.49	1.99	1.95	2.00	1.85	1.80	2.04	2.06	2.30	1.93	2.00	1.40
Texas	1.41	1.31	1.21	1.53	1.43	1.80	1.25	1.40	1.84	1.77	1.90	1.80	1.30	1.65
Oklahoma	......	......	1.32	1.35	1.27	1.43	1.04	1.27	1.36	1.50	1.41	1.40	1.20	1.45
Arkansas	1.37	1.35	1.20	1.49	1.48	1.63	1.10	1.60	1.60	1.72	1.75	1.60	1.25	1.50
Montana	......	1.09	1.13	1.64	1.42	1.60	1.79	1.68	2.08	1.92	1.60	1.85	1.70	2.00
Wyoming	......	1.21	1.17	1.86	1.47	1.68	1.76	1.65	2.14	2.27	2.50	2.25	2.10	2.00
Colorado	......	1.18	1.63	2.20	2.10	2.23	2.08	1.92	2.56	1.85	2.65	2.50	2.70	2.50
New Mexico	......	1.14	1.49	2.64	1.70	2.06	2.31	2.40	2.36	2.58	2.70	2.50	2.05	2.00
Arizona	......	1.00	1.47	2.98	2.63	2.31	2.85	2.34	3.46	2.71	3.75	3.50	2.90	3.20
Utah	......	1.30	1.66	2.89	2.50	2.65	2.45	2.62	2.95	3.54	3.25	4.00	2.10	2.50
Nevada	1.41	1.35	1.90	2.60	1.87	2.43	2.50	2.91	3.12	3.04	2.50	1.50	1.75	2.00
Idaho	......	1.21	1.64	2.79	2.50	2.80	2.58	2.67	2.82	3.07	3.10	2.95	2.40	3.25
Washington	......	1.34	1.50	2.20	2.02	2.16	2.30	2.29	2.41	2.18	2.65	2.38	2.10	2.25
Oregon	1.46	1.56	1.52	2.06	1.97	2.35	2.07	2.04	2.07	2.04	2.30	2.18	2.00	2.00
California	1.42	1.47	1.51	1.81	1.63	1.51	1.82	1.81	2.08	2.03	2.40	1.85	1.75	1.35
United States	1.22	1.25	1.18	1.44	1.35	1.28	1.28	1.50	1.54	1.52	1.54	1.35	1.45	1.52
Division:[a]														
N. Atlantic	1.15	1.13	1.10	1.21	1.06	.95	1.24	1.26	1.21	1.31	1.31	1.26	1.37	1.24
S. Atlantic	1.17	1.16	1.09	1.30	1.22	1.22	1.31	1.12	1.37	1.46	1.41	1.36	1.45	1.45
N. Central E. of Miss. R.	1.28	1.31	1.17	1.39	1.32	1.20	1.25	1.53	1.52	1.41	1.50	1.18	1.36	1.54
N. Central W. of Miss. R.	1.48	1.37	1.17	1.50	1.40	1.31	1.08	1.66	1.66	1.60	1.50	1.23	1.40	1.58
S. Central	1.29	1.27	1.22	1.46	1.39	1.60	1.33	1.41	1.59	1.61	1.58	1.54	1.37	1.50
Far Western	1.43	1.41	1.51	2.09	1.84	1.95	2.14	2.13	2.45	2.34	2.58	2.43	2.12	2.22

[a] See note *a*, page 590.

Average farm value per acre of hay in the United States December 1.

State, Territory, or Division.	10-year averages.				1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
	1866–1875.	1876–1885.	1886–1895.	1896–1905.										
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls*
Maine	11.29	11.13	10.20	10.50	9.09	11.66	10.96	10.74	10.00	10.09	10.09	12.30	18.75	12.60
N. Hampshire	13.34	11.08	11.19	13.42	10.46	13.48	15.87	14.36	12.20	13.76	15.08	14.38	21.26	14.72
Vermont	12.10	10.83	11.15	12.21	10.55	13.70	13.36	12.26	12.84	11.85	12.73	12.00	20.40	14.99
Massachusetts	21.80	18.90	18.00	20.27	17.52	16.88	21.16	26.64	22.74	19.38	20.24	22.27	24.68	20.40
Rhode Island	22.99	18.26	15.48	17.87	15.35	17.20	17.54	19.46	20.28	20.16	17.73	18.44	25.65	25.87
Connecticut	23.84	17.09	15.38	16.11	13.63	14.89	14.77	21.19	16.86	15.78	16.35	17.55	22.10	18.90
New York	16.32	13.36	11.89	12.41	10.87	11.38	13.75	14.11	13.81	14.20	13.49	15.49	19.37	14.70
New Jersey	23.95	17.75	15.57	18.04	12.74	20.22	18.86	19.08	19.70	20.39	16.74	21.05	24.66	22.39
Pennsylvania	16.99	14.45	12.76	15.30	13.80	15.29	15.90	16.66	17.15	17.14	17.90	17.42	22.84	18.00
Delaware	19.64	15.56	14.50	16.15	12.12	13.67	13.84	15.73	24.32	22.09	21.19	18.75	24.45	20.03
Maryland	19.06	15.06	13.29	14.57	13.73	15.31	16.07	14.19	17.38	16.97	15.50	17.01	22.39	19.20
Virginia	15.98	15.21	12.13	14.04	11.27	15.43	14.41	14.39	17.85	17.44	16.41	19.37	22.06	15.94
W. Virginia	12.13	11.44	10.34	15.53	12.19	15.81	18.91	16.05	19.04	18.24	17.24	19.60	22.48	15.95
N. Carolina	14.01	14.11	14.17	17.35	15.15	15.79	17.93	17.64	21.47	25.04	20.48	23.10	24.69	20.21
S. Carolina	19.34	15.57	13.93	15.45	12.56	15.18	16.03	13.72	17.11	18.64	18.97	22.27	24.89	18.45
Georgia	22.96	19.33	16.22	20.32	19.07	21.55	20.92	18.22	23.18	23.01	23.63	25.99	31.45	25.07
Florida	24.49	17.74	21.24	20.93	22.41	16.44	22.72	19.02	27.67	22.67	24.05	22.50	25.64	20.26
Ohio	13.15	12.19	11.02	11.71	11.63	11.71	11.86	14.59	14.20	13.23	11.92	14.64	17.05	13.31
Indiana	12.48	11.25	10.26	10.89	10.45	11.80	11.79	12.66	12.58	11.75	11.16	13.75	16.20	13.20
Illinois	11.12	10.45	9.49	10.87	10.00	10.67	12.10	13.31	12.83	11.78	11.10	12.25	15.40	12.55
Michigan	14.46	13.61	11.29	11.17	10.37	12.19	10.85	12.03	12.23	11.30	11.24	13.25	15.62	12.09
Wisconsin	11,62	11.28	9.51	11.66	10.07	11.10	13.58	15.03	14.17	13.18	13.05	12.15	15.53	13.00
Minnesota	6.38	7.28	6.27	8.67	7.40	8.06	8.65	9.43	12.16	9.59	10.15	9.35	12.75	9.07
Iowa	8.23	6.73	7.02	8.61	7.10	9.66	9.59	10.92	9.72	8.08	8.67	9.45	11.20	9.69
Missouri	13.17	10.23	8.10	9.31	8.56	8.97	8.99	10.96	10.49	9.73	8.62	7.80	12.95	10.50
N. Dakota	......	......	4.74	5.82	5.21	5.20	5.84	6.09	5.48	6.61	6.71	6.52	8.45	6.24
S. Dakota	......	......	4.28	5.04	4.43	4.66	5.16	5.10	6.71	6.06	6.43	6.75	7.70	6.15
Nebraska	6.35	5.08	4.85	6.54	6.14	7.11	7.71	7 59	7.53	6.72	7.24	7.84	9.37	7.59
Kansas	6.64	5.74	5.10	6.38	5.49	6.01	7.25	7.33	7.60	7.31	7.87	8.00	8.34	8.55
Kentucky	14.88	13.36	12.17	14.58	13.42	15.89	16.25	16.27	17.62	16.57	13.82	17.89	18.22	14.85
Tennessee	18.93	15.29	13.05	16.82	14.74	16.52	18.71	16.99	19.42	19.04	18.43	20.31	22.48	17.70
Alabama	20.00	19.05	17.34	18.93	18.92	19.52	21.12	17.42	21.93	20.74	23.79	25.93	27.45	20.00
Mississippi	21.76	19.61	15.55	16.35	13.32	17.41	17.62	14.35	20.18	18.00	19.55	21.76	20.80	16.57
Louisiana	24.50	15.71	15.26	20.66	18.92	18.80	20.50	21.10	23.15	25.13	26.45	22.20	30.00	15.50
Texas	16.95	13.78	10.43	11.92	10.15	12.24	13.27	12.04	15.09	14.37	15.43	15.30	13.97	13.61
Oklahoma	......	......	10.40	7.56	4.23	6.09	7.29	6.66	7.70	7.33	6.99	8.00	7.79	7.25
Arkansas	20.10	16.97	11.75	13.48	12.80	14.43	12.89	15.04	15.17	16.89	16.80	15.84	14.08	14.63
Montana	......	11.96	11.10	12.91	10.93	13.92	14.60	12.67	18.32	16.70	12.32	16.40	16.15	16.70
Wyoming	......	14.59	9.90	12.28	9.70	12.26	12.64	12.01	14.27	13.05	15.52	17.44	15.75	14.80
Colorado	......	18.64	13.84	16.15	15.43	16.95	18.80	18.99	19.15	12.41	21.73	23.75	25.65	21.87
New Mexico	......	16.24	15.03	25.19	18.02	20.39	23.89	26.83	26.24	29.46	29.03	26.88	24.09	10.00
Arizona	......	14.50	14.74	31.71	27.22	26.10	26.16	28.62	35.78	40.22	46.39	42.00	40.00	30.09
Utah	......	8.15	11.07	18.76	17.75	21.07	20.70	19.18	20.18	22.34	21.68	20.00	14.71	18.51
Nevada	29.02	16.74	15.71	19.55	14.31	18.71	19.80	29.73	31.11	23.10	21.25	12.00	17.47	17.60
Idaho	......	13.01	11.97	16.18	15.75	18.20	15.25	14.69	19.64	18.67	18.29	23.60	20.39	23.07
Washington	......	14.74	13.56	20.53	17.98	20.52	19.60	20.45	30.78	24.72	25.63	26.18	31.52	24.74
Oregon	18.83	17.50	12.90	16.07	13.49	15.98	14.82	15.26	21.07	20.77	17.80	17.11	20.50	18.60
California	23.08	17.85	14.44	17.23	13,04	12.31	14.41	17.03	24.25	21.13	24.12	20.81	21.88	17.89
United States	14.10	11.51	9.91	11.62	9.97	11.39	12.85	13.61	13.93	13.23	13.11	13.95	16.89	13.67
Division: [a]														
N. Atlantic	16.43	13.73	11.43	13.76	11.93	13.45	14.72	15.32	14.88	14.94	14.90	15.94	20.91	16.12
S. Atlantic	16.03	14.27	12.31	15.57	12.87	15.89	16.80	15.41	19.06	18.80	17.61	19.81	23.27	17.60
N. Central E. of Miss. R.	12.44	11.51	10.25	11.26	10.52	11.48	11.96	13.53	13.22	12.27	11.67	13.25	15.95	13.66
N. Central W. of Miss. R.	8.41	6.93	6.17	7.52	6.48	7.54	8.66	9.69	9.53	8.63	8.47	8.47	10.91	9.16
S. Central	16.81	14.53	12.22	12.31	13.09	15.12	14.72	13.71	15.93	15.29	14.45	16.13	16.47	12.86
Far Western	23.01	16.61	13.45	16.91	13.95	15.27	17.18	17.66	22.16	19.36	21.02	22.11	21.71	20.09

[a] See note *a*, page 599.

Average farm price of hay per ton in the United States.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan. 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Maine	12.98	11.36	13.02	10.10	10.10	12.95	10.44	10.04	10.20	9.72	9.90	10.25	12.50	14.60	12.50	12.83	12.75	12.50	14.45	14.00
New Hampshire	13.34	11.54	11.54	12.66	11.75	15.50	12.40	13.55	13.26	13.49	13.00	12.50	15.75	16.00	16.00	16.70	17.00	17.25	16.50	17.00
Vermont	11.52	10.22	9.78	9.54	9.25	11.05	9.82	9.65	10.88	9.48	9.43	10.00	12.75	13.50	12.00	12.00	15.00	13.00	14.50	13.00
Massachusetts	19.82	16.58	15.93	15.71	15.50	17.40	17.49	16.65	16.72	15.76	15.22	17.00	19.00	17.00	18.50	19.17	19.00	18.50	18.00	17.25
Rhode Island	22.11	17.56	16.47	17.02	17.25	18.70	19.06	18.89	18.95	17.38	16.27	17.40	19.00	17.25	19.25	21.50	19.25	19.50	21.00	18.00
Connecticut	19.38	15.08	15.23	14.51	14.50	16.73	14.62	15.70	15.19	14.89	14.00	15.00	17.00	15.75	17.00	19.17	18.50	18.00	16.25	15.75
New York	13.49	11.52	10.62	10.34	10.45	14.05	10.58	10.53	10.96	10.44	10.38	12.10	15.50	12.25	15.25	15.09	14.50	13.25	12.00	12.00
New Jersey	13.86	15.30	13.31	14.09	15.35	16.05	14.29	15.64	15.39	14.67	14.81	15.95	17.00	14.00	17.00	17.09	17.00	14.25	12.50	13.50
Pennsylvania	14.28	11.94	11.10	11.95	11.50	13.90	13.64	14.00	13.50	11.82	11.93	13.40	15.75	12.00	16.00	15.29	15.00	12.50	11.00	11.50
Delaware	17.38	14.96	12.83	12.62	11.65	13.95	12.36	14.43	14.83	13.89	13.67	15.00	17.50	12.50	17.00	17.50	16.25	12.00	11.25	12.00
Maryland	17.02	13.69	11.56	12.35	12.15	14.05	13.17	14.05	14.02	12.48	11.92	13.50	16.00	12.00	15.25	14.77	14.75	11.50	12.00	11.75
Virginia	13.43	12.78	11.44	11.70	10.25	13.30	12.01	13.58	13.73	12.55	12.62	15.50	15.75	12.25	15.00	15.65	14.50	13.50	12.25	12.00
West Virginia	10.46	9.86	10.34	11.59	9.45	13.40	13.80	14.33	13.80	12.41	11.65	14.00	15.50	11.00	14.00	13.55	13.75	13.00	11.00	11.00
North Carolina	10.86	11.11	11.16	11.49	10.10	11.20	10.80	12.25	13.42	14.56	12.80	15.00	16.50	13.50	15.00	14.56	15.50	15.00	13.75	13.00
South Carolina	19.54	13.31	11.51	11.36	10.30	11.50	10.98	11.25	11.72	12.18	13.36	15.25	16.50	14.80	16.00	15.83	16.75	16.25	15.50	15.00
Georgia	18.37	14.11	12.98	13.55	13.15	12.75	14.33	13.40	15.15	15.14	15.75	15.75	18.00	14.35	16.00	15.84	18.00	17.00	15.00	14.25
Florida	15.21	16.74	15.39	15.28	15.35	13.70	15.35	15.34	18.82	16.67	16.25	15.00	19.00	14.80	16.00	17.44	17.00	16.50	15.25	15.00
Ohio	10.96	9.83	9.42	8.61	8.95	11.05	8.72	10.20	10.00	9.25	8.00	12.00	11.75	8.70	11.70	10.80	10.00	8.30	8.20	8.15
Indiana	9.75	8.52	8.77	7.89	7.80	9.75	9.28	8.67	8.56	8.58	7.54	12.50	12.00	8.80	11.75	10.75	10.75	8.50	8.00	8.50
Illinois	8.18	7.57	8.11	7.99	7.75	8.40	11.20	8.87	8.33	8.66	8.27	12.50	11.00	8.20	11.00	10.74	10.50	8.30	8.00	8.00
Michigan	11.85	10.55	9.82	8.40	8.50	9.45	8.01	8.30	8.93	9.09	7.70	10.35	12.50	8.75	12.50	11.95	11.00	9.25	8.65	8.90
Wisconsin	8.67	8.61	8.06	7.02	6.85	9.05	10.53	7.91	7.50	7.89	7.25	9.00	11.50	8.00	11.00	10.48	10.00	9.00	8.20	8.25
Minnesota	4.83	5.16	4.08	5.22	4.35	6.95	5.58	5.36	6.61	5.51	5.80	5.50	7.50	5.40	5.75	5.89	5.25	5.50	5.50	5.50
Iowa	5.38	4.88	5.90	5.45	5.30	6.80	7.07	6.50	5.46	5.36	5.10	7.00	8.00	5.70	8.00	7.40	7.25	6.25	5.50	5.75
Missouri	9.02	7.99	7.04	7.00	6.25	6.95	11.99	6.89	6.08	6.02	7.84	10.00	9.25	7.00	8.50	8.07	8.25	8.10	7.25	6.90
North Dakota	......	......	4.05	3.93	3.30	5.05	3.05	3.67	4.04	4.21	4.33	4.50	6.50	4.80	5.00	4.59	4.50	5.25	4.30	4.40
South Dakota	......	......	4.00	3.76	3.10	3.95	4.49	4.15	4.63	4.24	4.02	4.50	5.50	4.10	4.75	3.85	4.00	4.50	4.00	3.80
Nebraska	4.07	3.50	4.29	4.06	3.70	5.15	6.17	4.36	4.48	3.82	4.14	5.00	6.25	4.90	6.00	5.27	4.50	4.75	4.25	4.70
Kansas	4.31	4.16	4.40	4.40	3.50	4.55	7.97	4.31	4.81	4.38	5.08	6.25	7.25	5.70	7.00	6.83	7.25	6.75	5.75	5.75
Kentucky	11.81	10.52	10.40	10.80	10.40	11.35	12.13	11.30	12.07	11.51	10.03	13.25	13.50	11.00	12.75	12.90	13.00	11.75	11.00	11.00
Tennessee	14.34	12.04	10.70	11.29	11.25	11.80	12.31	11.80	12.29	12.61	11.52	13.45	15.00	11.80	14.00	14.00	15.00	13.50	11.25	11.50
Alabama	16.39	14.22	12.04	11.20	11.40	10.55	12.07	11.61	12.39	12.13	12.52	13.30	15.25	12.50	14.50	13.04	15.00	15.00	13.25	13.20
Mississippi	17.13	14.42	10.80	10.09	9.25	9.95	10.51	10.25	11.60	10.85	11.17	11.45	13.00	11.00	11.50	12.39	14.00	15.00	11.00	11.75

Average farm price of hay per ton in the United States—Continued.

State, Territory, or Division.	Price December 1, by decades.				Price December 1, by years.										Price bimonthly, 1908.					
	1866–1875.	1876–1885.	1886–1895.	1896–1905.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Jan. 1.	Mar. 1.	May 1.	July 1.	Sept. 1.	Nov. 1.
	Dolls.	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*
Louisiana	16.90	13.43	10.24	10.38	9.70	9.40	11.08	11.72	11.35	12.20	11.50	11.50	15.00	11.00	11.00	12.29	11.25	9.50	11.00	9.25
Texas	12.02	10.52	8.62	7.79	7.10	6.80	10.62	8.60	8.20	8.12	8.12	8.50	10.75	8.25	10.75	10.98	10.75	9.50	8.50	8.50
Oklahoma			7.88	5.60	3.33	4.26	7.00	5.26	5.65	4.87	4.96	5.72	6.50	5.00	6.00	6.03	6.75	6.00	5.50	5.50
Arkansas	14.67	12.57	9.79	9.05	8.65	8.85	11.72	9.40	9.48	9.82	9.00	9.90	11.75	9.75	11.00	10.91	10.75	10.50	9.75	9.00
Montana		10.97	9.82	7.87	7.70	8.70	8.18	7.54	8.81	8.70	7.70	8.90	9.50	8.35	8.25	8.72	8.00	8.25	9.10	9.15
Wyoming		12.06	8.46	6.60	6.60	7.30	7.18	7.28	6.67	5.75	6.21	7.75	7.50	7.40	7.50	8.15	8.00	8.00	7.50	7.75
Colorado		15.80	8.49	7.34	7.35	7.60	9.04	9.89	7.48	6.71	8.20	9.50	9.50	8.75	8.50	9.10	8.50	8.00	8.75	8.50
New Mexico		14.25	10.09	9.54	10.60	9.90	10.34	11.18	11.12	11.42	10.75	10.75	11.75	9.50	10.25	10.51	9.75	9.00	9.50	8.25
Arizona		14.50	10.03	10.64	10.35	11.30	9.18	12.23	10.34	14.84	12.37	12.00	14.00	12.20	12.50	12.80	11.00	8.50	10.50	9.00
Utah		6.27	6.67	6.49	7.10	7.95	8.45	7.32	6.84	6.31	6.67	7.50	7.00	7.40	8.50	7.23	7.75	7.50	6.75	6.75
Nevada	20.58	12.40	8.27	7.52	7.65	7.70	7.92	9.05	9.97	7.60	8.50	8.00	10.00	8.80	10.00	11.25	10.00	10.50	9.75	8.75
Idaho		10.75	7.30	5.80	6.30	6.50	5.91	5.50	6.86	6.08	5.90	8.00	8.50	7.10	7.25	7.25	7.00	8.00	6.75	6.50
Washington		11.00	9.04	9.33	8.90	9.50	8.52	8.93	12.77	11.34	9.67	11.00	15.00	11.00	12.50	11.57	10.50	10.50	9.75	10.75
Oregon	12.90	11.22	8.49	7.80	6.85	6.80	7.16	7.48	10.18	10.18	7.74	7.85	10.25	9.30	9.75	9.92	9.00	9.25	8.25	9.00
California	16.25	12.14	9.56	9.52	8.00	8.15	7.92	9.41	11.66	10.41	10.05	11.25	12.50	13.25	10.50	10.93	11.75	10.75	10.80	12.00
United States	11.56	9.21	8.40	8.07	7.27	8.89	10.01	9.06	9.08	8.72	8.52	10.37	11.68	8.98	11.28	11.02	10.78	9.79	9.18	9.22
Division:[a]																				
North Atlantic	14.29	12.15	11.30	11.37	11.29	14.10	11.92	12.13	12.31	11.39	11.37	12.64	5.26	13.00	15.17	15.14	15.06	13.67	12.95	12.91
South Atlantic	13.70	12.30	11.29	11.98	10.55	13.05	12.78	13.70	13.88	12.90	12.49	14.60	16.05	12.14	14.89	14.76	14.78	13.36	12.35	11.95
North Central East of Mississippi River	9.72	8.79	8.76	8.10	7.96	9.59	9.56	8.86	8.69	8.72	7.78	11.19	11.73	8.48	11.58	10.94	10.43	8.66	8.21	8.35
North Central West of Mississippi River	5.68	5.06	5.27	5.01	4.35	5.76	8.02	5.84	5.73	5.40	5.66	6.88	7.79	5.80	7.30	6.86	6.73	6.45	5.74	5.78
South Central	13.03	11.44	10.02	8.43	9.38	9.47	11.10	9.71	10.02	9.51	9.15	10.44	12.02	8.57	11.32	11.26	11.83	10.63	9.46	9.44
Far Western	16.09	11.78	8.91	8.09	7.56	7.82	8.62	8.30	9.03	8.26	8.15	9.10	10.24	9.05	9.25	9.44	9.01	8.94	8.81	8.99

[a] See note *a*, page 599.

Wholesale prices of hay (baled) per ton, 1895–1908.

Date.	Chicago.		Cincinnati.		St. Louis.		New York.	
	No. 1 timothy.		No. 1 timothy.		No. 1 timothy.[a]		No. 1 timothy.[b]	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1895	$10.00	$14.50	$10.00	$19.00	$10.50	$17.25	$0.65	$1.05
1896	8.00	12.50	9.00	15.00	9.00	15.50	.75	1.05
1897	7.50	9.00	8.00	11.50	8.50	14.00	.72½	.90
1898	7.50	10.50	7.50	10.25	7.00	12.50	.65	.80
1899	7.50	13.00	7.75	13.00	8.00	12.00	.65	.95
1900	10.00	14.00	11.50	15.00	9.75	14.50	.87½	.97½
1901	11.50	15.00	11.50	15.50	11.50	17.50	.87½	1.00
1902	10.00	17.50	11.00	16.50	9.50	16.00	17.00	22.00
1903	10.00	15.00	11.50	19.50	9.50	25.00	16.00	26.00
1904	9.00	15.00	11.00	15.50	10.00	13.50	15.00	19.00
1905.								
January	10.50	12.00	12.00	12.75	11.00	12.75	15.50	17.00
February	11.00	12.00	11.75	12.25	10.50	12.50	15.50	16.00
March	11.00	12.00	11.75	13.00	10.50	12.50	15.00	17.50
April	11.00	12.00	12.00	12.50	11.00	13.00	15.00	16.00
May	11.00	12.00	11.50	12.50	10.50	13.00	15.00	16.00
June	10.00	12.00	10.25	11.75	10.50	12.50	15.00	16.00
July	10.00	12.00	10.50	12.50	10.00	14.00	14.00	15.00
August	11.00	12.50	10.00	12.50	9.00	13.50	15.00	19.00
September	10.00	12.50	11.50	12.50	10.00	13.00	14.50	16.00
October	10.00	11.50	12.25	12.50	10.50	13.50	15.00	16.00
November	11.00	12.00	12.00	13.50	12.00	15.00	15.00	16.50
December	10.00	12.00	12.25	13.50	12.50	15.50	14.00	15.00
1906.								
January	10.00	11.00	12.00	13.00	12.00	14.00	16.00	17.00
February	9.50	10.50	11.00	12.50	11.50	14.00	15.00	16.50
March	9.80	12.00	12.50	13.50	12.00	15.00	15.50	16.00
April	10.00	12.50	13.50	14.75	13.50	17.00	15.50	19.00
May	11.50	12.50	14.50	16.25	14.50	18.00	17.50	19.50
June	11.50	13.00	15.00	16.00	14.00	17.00	18.00	19.00
July	12.00	16.00	15.50	18.00	11.00	17.50	18.00	20.00
August	13.00	16.00	15.25	16.00	12.00	16.50	18.00	20.00
September	13.50	16.00	15.00	16.25	13.50	15.50	17.50	19.00
October	13.50	15.50	16.00	18.25	14.50	16.50	17.50	21.00
November	15.00	17.00	17.75	19.00	15.00	18.50	19.00	23.00
December	15.50	18.00	19.00	19.50	17.50	20.00	20.00	22.00
1907.							Per 100 pounds.	
January	14.50	16.50	18.00	19.50	17.00	19.00	1.05	1.10
February	15.00	17.00	18.00	19.00	16.50	19.00	1.05	1.10
March	15.00	17.00	18.50	19.50	16.75	19.00	1.10	1.20
April	15.00	18.00	19.00	20.50	16.50	18.50	1.10	1.20
May	15.50	20.50	19.75	22.75	17.00	20.50	1.15	1.25
June	18.50	21.50	20.00	22.00	18.00	21.50	1.15	1.25
July	17.50	19.00	17.00	21.75	18.00	21.00	1.10	1.20
August	18.00	19.50	14.00	18.50	15.00	24.00	1.15	1.20
September	15.00	19.50	14.50	17.50	15.00	22.00	1.00	1.20
October	14.50	19.00	16.00	17.75	14.00	19.50	1.00	1.15
November	14.50	17.00	14.50	16.75	14.50	18.25	1.05	1.10
December	13.00	17.50	15.00	16.50	14.00	18.00	1.00	1.10
1908.							Per ton.	
January	12.50	13.50	14.25	16.50	13.00	18.00	20.00	21.00
February	13.00	13.50	13.75	15.25	13.00	16.50	18.00	20.00
March	12.00	13.50	13.50	15.75	13.00	16.50	19.00	21.00
April	13.00	14.00	13.75	15.00	13.00	16.50	17.00	19.00
May	13.00	14.00	13.00	14.25	14.00	17.00	18.00	19.50
June	10.00	11.00	11.50	12.75	10.50	16.00	16.00	18.00
July	10.00	10.50	12.50	14.00	10.50	16.00	15.00	17.00
August	10.00	11.00	11.50	12.75	10.00	16.00	16.50	18.00
September	10.00	10.50	11.75	13.00	12.00	15.00	14.00	17.00
October	10.00	11.50	12.50	13.50	11.50	13.50	15.00	17.00
November	11.50	12.50	12.50	13.00	11.00	14.50	16.00	16.50
December	11.50	12.00	12.50	14.00	10.50	14.00	17.00	18.00

[a] Choice timothy, 1895 and 1896.

[b] Per hundredweight, 1895 to 1901.

CLOVER AND TIMOTHY SEED.

Wholesale prices of clover and timothy seed, 1896–1908.

Date.	Clover (bushels of 60 pounds).								Timothy (bushels of 45 pounds).							
	Cincinnati.		Chicago.		Toledo.		Detroit.		Cincinnati.		Chicago.		Milwaukee.		St. Louis.	
	Prime (per bushel).		Poor to choice (per bushel).[a]		Prime (per bushel).[b]		Per bushel.		Per bushel.		Per 100 pounds.		Per 100 pounds.		Poor to prime (per 100 pounds).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1896	$2.75	$5.00	$1.20	5.40	$4.20	$5.95	....	....	$1.15	$2.25	$1.50	$4.00	$1.90	$3.75	....	....
1897	2.75	4.50	1.20	5.55	3.10	5.32½	$3.00	$5.35	1.15	1.25	2.50	3.10	2.00	3.10	....	....
1898	2.45	3.75	.60	4.80	2.80	5.15	2.80	5.20	.95	1.25	2.15	3.00	1.50	3.00	....	....
1899	2.75	4.50	.90	5.16	3.42½	6.80	3.40	6.50	.95	1.15	2.25	2.55	1.70	2.80	....	....
1900	4.00	6.00	2.40	6.30	4.95	7.85	4.80	7.10	1.03	2.00	2.32½	4.65	1.90	4.50	....	....
1901	4.50	6.60	2.40	6.90	5.15	7.40	5.15	7.35	1.70	2.90	3.35	6.55	3.00	6.25	....	....
1902	4.11	5.76	2.40	6.81	3.90	7.10	4.90	6.10	1.98	3.96	2.00	7.35	2.50	6.75	$2.40	$6.40
1903	5.00	7.10	2.40	7.50	3.05	7.70	6.45	7.50	1.20	1.70	1.75	4.35	2.00	3.75	2.00	3.60
1904	4.80	7.50	3.00	7.80	2.50	7.95	6.20	7.95	1.15	1.35	1.75	3.25	2.00	3.15	2.00	2.80
1905.											(b)					
January	6.40	7.00	4.80	7.80	3.25	8.00	7.45	7.90	1.15	1.30	1.75	2.80	2.25	2.65	2.00	2.40
February	6.40	7.00	5.40	7.50	4.00	7.00	7.40	7.55	1.15	1.30	2.00	2.92½	2.25	2.65	2.00	2.50
March	6.40	7.00	5.40	8.25	3.00	8.20	7.55	8.15	1.15	1.30	2.25	3.10	2.25	2.90	2.00	2.50
April	6.40	7.75	4.80	8.64	3.00	8.85	8.00	8.75	1.15	1.30	2.00	3.10	2.50	2.90	2.00	2.75
May	6.25	7.75	4.80	8.10	3.50	8.00	7.00	8.00	1.20	1.30	2.00	3.10	2.50	2.90	2.00	2.50
June	6.25	6.75	4.80	7.80	5.50	7.40			1.20	1.30	2.00	3.00	2.25	2.90	2.00	2.50
July	6.25	6.75	5.40	7.80	5.75	7.50	....	....	1.20	1.30	2.50	3.30	2.25	2.95	2.40	2.75
August	....	....	5.10	7.80	4.00	7.50	....	....	1.20	1.45	2.00	3.60	2.35	3.50	2.40	3.70
September	5.70	6.00	5.40	7.35	3.00	7.45	6.30	7.40	1.40	1.60	2.00	3.75	2.70	3.40	3.00	3.70
October	5.70	7.00	5.70	7.95	3.00	8.22½	7.50	8.25	1.35	1.55	2.00	3.40	2.40	3.50	2.50	3.10
November	6.50	7.00	6.00	7.95	4.00	8.12½	7.95	8.10	1.35	1.40	1.50	3.50	2.50	3.10	2.50	2.80
December	6.50	7.50	6.00	7.95	4.00	8.30	8.00	8.15	1.30	1.35	1.50	3.50	2.50	3.10	2.50	2.80
1906.																
January	6.50	7.50	6.00	7.95	5.00	8.35	8.10	8.30	1.30	1.35	2.00	3.40	2.50	3.10	2.60	2.80
February	6.50	7.50	6.00	8.49	4.00	8.72½	8.20	8.70	1.30	1.35	2.25	3.35	2.60	2.80	2.60	3.20
March	6.50	7.50	5.70	8.40	3.30	8.40	7.30	8.35	1.30	1.35	2.00	3.25	2.40	2.75	2.50	3.05
April	6.00	7.50	4.20	8.10	3.25	7.85	6.25	7.80	1.30	1.35	2.00	3.20	2.45	2.80	2.50	3.20
May	6.00	6.50	3.90	6.90	3.00	6.80	6.25	6.75	1.30	1.35	2.00	3.35	2.00	2.95	2.40	3.20
June	4.50	5.50	4.20	6.75	5.00	6.90	6.65	6.75	1.35	1.45	2.25	4.25	2.70	4.00	2.40	4.00

[a] Poor to prime, 1905 to 1908.

[b] Poor to choice, 1896 to 1901, and 1907 and 1908.

1906																
July	4.50	6.00	4.20	6.75	5.25	7.10	6.65	6.95	1.50	1.80	2.50	4.25	3.25	4.00	3.00	4.00
August	4.50	7.00	4.20	7.50	4.50	7.35	7.00	7.50	1.50	1.80	2.50	4.10	3.15	3.75	3.00	4.00
September	5.00	7.00	4.80	7.65	3.50	8.10	7.30	7.90	1.50	1.80	3.00	4.30	3.10	3.75	3.60	4.00
October	5.00	7.25	4.80	7.80	3.60	8.50	7.95	8.30	1.50	1.80	3.00	4.25	3.10	3.75	3.25	4. 0
November	7.00	7.50	4.80	8.04	3.50	8.30	8.00	8.25	1.50	1.80	3.00	4.40	3.10	3.75	3.25	4.00
December	7.00	7.50	5.10	8.40	3.00	8.47½	8.20	8.40	1.50	1.85	3.25	4.50	3.10	4.25	3.25	4.00
1907.																
January	7.00	7.50	5.40	8.40	3.00	8.65	8.30	8.60	1.50	1.85	3.25	4.45	3.50	4.25	3.25	4.25
February	7.00	7.50	5.40	8.31	3.00	8.47½	8.00	8.45	1.50	2.00	3.15	4.55	3.50	4.35	3.50	4.45
March	7.00	7.50	5.40	9.45	3.15	9.50	8.00	9.25	1.75	2.00	3.00	4.60	3.50	4.35	3.00	4.45
April	7.00	7.50	4.80	9.30	3.10	9.35	8.45	9.25	1.75	2.00	3.00	4.35	3.40	4.15	3.00	4.00
May	7.00	7.50	4.80	9.15	3.25	9.25	8.75	9.25	1.75	2.25	3.25	4.75	3.25	4.00	3.00	4.05
June	7.00	7.50	5.10	9.15	7.25	9.35	9.00	9.00	1.75	2.00	3.50	4.75	3.75	4.50	3.00	4.00
July	7.00	7.50	5.10	9.30	3.05	9.60	9.00	9.25	1.75	2.00	3.50	4.75	3.75	4.65	3.25	4.25
August	7.50	8.50	5.10	9.75	8.00	10.00	9.00	9.50	1.75	2.15	3.50	4.65	3.50	4.65	3.25	4.50
September	7.50	8.50	5.40	10.05	6.50	10.75	9.00	10.50	1.75	2.15	3.50	4.75	3.50	4.40	3.75	4.60
October	7.50	8.50	6.00	10.20	3.00	11.00	9.50	10.75	1.75	2.15	3.50	4.60	3.80	4.40	3.50	4.50
November	7.50	8.50	5.40	9.90	3.00	9.80	9.35	9.50	1.75	2.15	3.25	4.70	3.50	4.40	3.50	4.30
December	7.50	8.50	5.70	10.20	3.00	10.37½	9.50	10.25	1.75	2.15	3.00	4.35	3.50	4.25	3.50	4.20
1908.																
January	7.50	10.00	6.00	11.25	6.25	11.40	10.25	11.20	1.75	2.15	4.35	4.55	3.75	4.40	3.50	4.50
February	7.50	10.00	7.20	11.76	6.65	11.77⅓	11.20	11.60	1.75	2.15	4.60	4.85	3.75	4.60	3.75	4.50
March	7.50	11.00	7.35	13.05	8.50	13.35	11.40	13.00	1.75	2.15	4.50	4.85	3.50	4.30	3.65	4.25
April	8.00	11.00	4.80	14.40	7.00	13.55	11.50	13.00	1.75	2.05	4.25	4.65	2.75	4.10	3.00	4.00
May	8.00	11.00	4.80	10.20	5.50	13.25	12.00	12.50	1.75	2.05	4.10	4.25	2.75	4.00	3.00	3.75
June	8.00	11.00	4.80	10.20	6.00	13.00	....	....	1.75	2.05	3.80	4.00	3.00	4.00	3.00	3.75
July	8.00	11.00	4.80	10.20	6.00	13.00	....	....	1.75	2.05	3.92½	4.10	3.25	4.00	3.00	3.50
August	5.50	6.00	4.20	10.20	5.20	13.00	....	....	1.65	2.05	3.60	3.80	2.85	3.75	3.00	4.00
September	4.50	5.50	4.50	6.00	4.75	5.95	5.50	5.60	1.50	1.65	3.25	3.75	2.50	3.50	2.00	3.50
October	4.00	5.50	3.60	5.70	3.90	5.60	4.60	5.60	1.35	1.65	3.40	3.75	2.50	3.25	2.25	3.35
November	4.00	5.00	3.60	5.70	4.00	5.65	5.00	5.60	1.35	1.55	3.75	4.00	2.50	3.50	2.50	3.35
December	4.00	5.00	3.90	5.67	4.40	5.72½	5.45	5.65	1.35	1.55	3.70	3.85	2.75	3.65	2.50	3.45

WOOD PULP.

International trade in wood pulp, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	105,874,767	147,236,342	166,589,396	170,770,020	[b] 187,246,042
Belgium	Jan. 1	55,958,478	68,359,246	54,872,925	68,233,066	72,943,332
Canada	Jan. 1	296,000,000	359,000,000	349,000,000	397,000,000	483,000,000
Finland	Jan. 1	80,804,723	130,027,777	133,477,320	123,858,426	133,408,038
Germany [c]	Jan. 1	161,354,520	155,086,119	153,651,351	156,740,026	211,885,779
Norway	Jan. 1	987,105,611	981,629,727	975,158,500	1,114,716,540	1,227,103,672
Sweden	Jan. 1	790,806,214	865,367,383	846,213,535	914,501,238	1,170,316,873
Switzerland	Jan. 1	15,455,503	14,938,960	14,004,420	13,901,905	13,066,133
United States	Jan. 1	30,552,552	20,172,901	26,379,946	28,267,309	24,839,012
Other countries		505,000	3,137,000	49,843,083	79,751,207	[b] 75,020,696
Total		2,524,417,368	2,744,955,455	2,769,190,476	3,067,739,737	3,598,829,577

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	26,578,411	35,123,171	30,886,404	37,368,826	40,845,920
Austria-Hungary	Jan. 1	4,981,343	5,342,681	4,702,018	4,050,552	[b] 5,421,827
Belgium	Jan. 1	159,206,350	177,288,153	174,530,060	228,929,053	243,156,228
Denmark	Jan. 1	61,638,806	64,605,345	67,310,417	64,300,231	80,113,097
France	Jan. 1	420,541,812	465,941,055	490,998,886	563,826,785	[b] 630,670,704
Germany [c]	Jan. 1	91,195,732	155,961,354	109,748,067	103,547,347	116,995,542
Italy	Jan. 1	67,924,624	85,246,119	93,789,911	114,677,382	[b] 126,865,854
Japan	Jan. 1	16,039,691	22,726,098	22,769,993	37,020,666	35,476,759
Russia	Jan. 1	57.929,301	49,107,233	44,467,063	46,715,121	[b] 34,451,611
Spain	Jan. 1	59,570,926	62,599,816	70,535,843	76,781,583	[b] 82,575,953
Sweden	Jan. 1	5,657,726	6,918,148	6,579,205	7,882,006	6,691,936
Switzerland	Jan. 1	10,344,527	14,229,512	19,680,440	16,764,828	19,232,681
United Kingdom	Jan. 1	1,281,295,680	1,263,028,480	1,280,780,480	1,341,735,360	1,484,703,360
United States	Jan 1	301,152,320	358,648,640	341,734,400	399,403,200	593,555,200
Other countries		15,693,000	6,753,000	122,801,943	118,569,048	[b] 117,331,832
Total		2,579,750,249	2,773,518,805	2,881,315,130	3,161,571,988	3,618,088,504

[a] See "General note," p. 605. [b] Preliminary. [c] Not including free ports prior to March 1, 1906.

COTTON.

Cotton crop of countries named, 1903–1907.

[No statistics for Siam and some other less important cotton-growing countries. Bales of 500 pounds, gross weight, or 478 pounds of lint, net.]

Country.	1903.	1904.	1905.	1906.	1907.
NORTH AMERICA.					
United States:	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Contiguous [a]	9,851,129	13,438,012	10,575,017	13,273,809	11,107,179
Noncontiguous—Porto Rico [b]	265	1,076	1,881	230	466
Total United States (except Philippine Islands)	9,851,394	13,439,088	10,576,898	13,274,039	11,107,645
Guatemala	147	[c] 147	[c] 147	[c] 147	[c] 147
Mexico	168,998	253,271	227,134	170,000	70,000
Nicaragua [b]	[d] 507	507	800	12	[c] 12
Salvador	[f] 2	[f] 2	2	[f] 2	[f] 2
West Indies:					
British—					
Bahamas [b]	13	18	14	27	18
Barbados	1	402	720	1,011	1,982
Grenada [b]	630	658	445	651	607
Jamaica [b]	6	30	184	40	13
Leeward Islands	[b] 124	[b] 243	[b] 822	[b] 986	1,954
St. Lucia [b]	....	5	3	2	....
St. Vincent [b]	91	264	289	550	895
Trinidad and Tobago	....	33	[b] 31	23	24
Turks and Caicos islands [b]	1	....	....	....	....
Cuba	77	[b] 61	[b] 21	[b] 1	[e] 1
French—					
Guadeloupe [b]	1	1	5	13	[e] 13
Martinique [b]	....	12	2	1	[e] 1
Haiti [b]	6,821	6,312	6,878	8,086	[e] 8,086
Total North America	10,028,813	13,701,054	10,814,395	13,455,591	11,191,400
SOUTH AMERICA.					
Argentina	[b] 26	[b] 142	[b] 495	[g] 10,000	[g] 10,000
Brazil [h]	285,000	220,000	270,000	365,000	348,000
British Guiana [b]	([i])	4	2	1	([i])
Chile [b]	1,182	634	1,335	1,357	1,134
Colombia and Venezuela [j]	5,000	5,000	5,000	5,000	5,000
Ecuador [b]	....	22	47	[f] 47	[f] 47
Peru	43,776	45,672	49,190	60,000	[k] 60,000
Paraguay [j]	200	200	200	200	200
Total South America	335,184	271,674	326,269	441,605	424,381
EUROPE.					
Bulgaria	731	772	864	874	[k] 874
Crete [j]	700	700	700	700	700
Greece	[j] 8,200	[j] 8,200	[j] 8,200	10,147	[k] 10,147
Italy [j]	2,700	2,700	2,700	2,700	2,700
Malta	285	345	340	348	463
Turkey	[g] 7,000	[g] 6,000	[g] 7,000	[k] 7,000	14,000
Total Europe	19,616	18,717	19,804	21,769	28,884
ASIA.					
British India, including native States [l]	3,573,000	3,727,000	3,921,000	4,487,000	3,748,000
Ceylon [b]	317	371	324	559	664
China [j]	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Cyprus	692	1,118	1,637	3,361	4,110
Dutch East Indies [b]	12,632	15,367	13,280	15,914	[e] 15,944
Federated Malay States	3	1	[g] 1	....	....

[a] "Linters," a by-product obtained in the oil mills, not included. Quantity of linters produced as follows: 194,486 500-pound bales in 1903, 241,942 in 1904, 229,539 in 1905, 321,689 in 1906, and 268,282 in 1907.
[b] Exports.
[c] Official estimate for 1903.
[d] Exports, 1904.
[e] Exports, 1906.
[f] Exports, 1905.
[g] Unofficial estimate.
[h] Exports and mill consumption.
[i] Less than one-half bale.
[j] Average production as unofficially estimated.
[k] Figures for the preceding year.
[l] Net exports and consumption.

Cotton crop of countries named, 1903–1907—Continued.

Country.	1903.	1904.	1905.	1906.	1907.
ASIA—continued.	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
French India [a]	......	[b] 14	14	......	(c)
French Indo-China [a]	13,693	15,255	18,103	11,082	16,191
Japan	17,012	16,262	12,370	9,239	[d] 9,239
Korea [e]	70,000	70,000	70,000	70,000	70,000
Persia [a]	56,282	71,509	81,931	91,431	[d] 91,431
Philippine Islands [f]	6,098	6,098	6,098	6,098	6,098
Russia, Asiatic:					
Central Asia	476,000	506,000	567,000	494,798	434,400
Transcaucasia	[g] 53,000	[g] 49,000	[g] 45,000	58,929	60,440
Total Asiatic Russia	529,000	555,000	612,000	553,727	494,840
Turkey, Asiatic [e]	60,000	60,000	60,000	60,000	60,000
Total Asia	5,538,729	5,737,995	5,996,758	6,508,441	5,716,517
AFRICA.					
British Africa:					
Central Africa [a]	118	597	1,625	1,101	844
East Africa	......	609	208	214	167
Gambia [a]	3	125	5	(c)	......
Gold Coast [a]	22	121	61	194	117
Natal	......	3	[g] 31	42	[a] 40
Nigeria—					
Colony of Lagos [a]	606	1,805	2,675	5,640	8,556
Southern, Protectorate [a]	......	598	201		
Northern, Protectorate [a]	......	601	258	745	590
Sierra Leone [a]	2	59	144	184	27
Uganda [a]	......	45	201	819	4,024
Total British Africa	751	4,563	5,409	8,939	14,365
Egypt	1,348,759	1,316,212	1,234,984	1,440,107	1,499,139
French Africa: [a]					
Algeria	......	......	......	8	73
Dahomey	......	289	[g] 84	......	(h)
Madagascar	(c)	8	11	333	[d] 333
Mayotte	1	......	......	(c)	(h)
Senegal	2	8	5	97	[d] 97
Somali Coast	......	41	106	9	(h)
Total French Africa	3	346	206	447	503
German Africa: [a]					
East Africa	43	872	871	870	1,068
Kamerun	......	......	......	2	(h)
Togo	148	499	618	892	1,297
Total German Africa	191	1,371	1,489	1,764	2,365
Italian Africa—Eritrea	......	43	62	[b] 62	[b] 62
Kongo Free State [a]	......	......	1	1	3
Portuguese Africa—					
Angola [i]	6	179	492	256	[d] 256
East Africa	......	......	26	[b] 26	[a] 6
Total Portuguese Africa	6	179	518	282	262
Sudan (Anglo-Egyptian)	6,517	15,097	19,441	17,782	[d] 17,782
Total Africa	1,356,227	1,337,811	1,262,110	1,469,384	1,534,481
OCEANIA.					
British—Queensland	1	18	79	54	76
French: [a]					
New Caledonia	......	1	(c)	......	(h)
Tahiti	71	48	39	110	[d] 110
German — Bismarck Archipelago [a]	240	56	15	38	5
Total Oceania	312	123	133	202	191
Grand total	17,278,881	21,037,374	18,419,469	21,896,992	18,895,854

[a] Exports.
[b] Figures for 1905.
[c] Less than one-half bale.
[d] Figures for 1906.
[e] Average production as unofficially estimated.
[f] Census, 1902.
[g] Unofficial estimate.
[h] No data.
[i] Imports from Angola into Portugal.

Cotton acreage (harvested), by States, 1903–1908.

[As reported by Bureau of Statistics, Department of Agriculture.]

State or Territory.	1903.	1904.	1905.	1906.	1907.	1908.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Virginia	39,864	47,199	38,664	36,000	35,000	28,000
North Carolina	1,155,028	1,306,968	1,085,568	1,374,000	1,408,000	1,458,000
South Carolina	2,318,100	2,531,875	2,161,923	2,389,000	2,426,000	2,545,000
Georgia	4,048,912	4,227,188	3,738,703	4,610,000	4,774,000	4,848,000
Florida	268,666	267,372	256,173	283,000	265,000	265,000
Alabama	3,608,049	3,611,731	3,500,168	3,658,000	3,439,000	3,591,000
Mississippi	3,327,960	3,632,458	3,051,265	3,408,000	3,220,000	3,395,000
Louisiana	1,642,463	1,745,865	1,561,774	1,739,000	1,622,000	1,550,000
Texas	7,801,578	8,355,491	6,945,501	8,894,000	9,156,000	9,316,000
Arkansas	1,925,191	2,051,185	1,718,751	2,097,000	1,950,000	2,296,000
Tennessee	783,196	881,341	757,397	814,000	749,000	754,000
Missouri	66,496	79,403	66,444	91,000	71,000	87,000
Oklahoma	326,391	502,021	418,184	1,030,000	2,196,000	2,311,000
Indian Territory	702,966	813,642	816,638	901,000		
United States	28,014,860	30,053,739	26,117,153	31,374,000	31,311,000	32,444,000

Production of lint cotton (excluding linters), in 500-pound gross weight bales, by States and total value of crop, 1903 to 1908.

[As finally reported by U. S. Census Bureau.]

State or Territory.	1903.	1904.	1905.	1906.	1907.	1908.
	Bales.	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Virginia	13,074	16,195	14,913	13,862	9,223	12,326
North Carolina	528,707	703,760	619,141	579,326	605,310	646,958
South Carolina	787,425	1,151,170	1,078,047	876,181	1,119,220	1,170,608
Georgia	1,267,364	1,887,853	1,682,555	1,592,572	1,815,834	1,931,179
Florida	52,386	79,171	68,797	55,945	49,794	62,080
Alabama	986,221	1,448,157	1,238,574	1,261,522	1,112,698	1,345,713
Mississippi	1,432,796	1,798,917	1,198,572	1,530,748	1,468,177	1,655,945
Louisiana	824,965	1,089,526	513,480	987,779	675,428	470,136
Texas	2,471,081	3,145,372	2,541,932	4,174,206	2,300,179	3,814,485
Arkansas	734,593	930,665	619,117	941,177	774,721	1,032,920
Tennessee	248,996	329,319	278,637	306,037	275,235	344,485
Missouri	37,813	51,570	42,730	54,358	36,243	61,907
Oklahoma	186,589	335,064	326,981	487,306	862,383	690,752
Indian Territory	278,347	469,254	350,125	410,520		
All other	772	2,019	1,416	2,270	2,734	2,296
United States	9,851,129	13,438,012	10,575,017	13,273,809	11,107,179	13,241,799
Total value of crop	$576,499,824	$561,100,386	$556,833,817	$640,311,538	$613,630,436	$588,814,828

Condition of the cotton crop in the United States, monthly, and average yield per acre, 1888–1908.

Year.	June.	July.	August.	September.	October.	Average yield per acre (lint).	Year.	June.	July.	August.	September.	October.	Average yield per acre (lint).
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*Lbs.*
1888	88.2	86.7	87.3	83.8	78.9	180.4	1899	85.7	87.8	84.0	68.5	62.4	184.0
1889	86.4	87.6	89.3	86.6	81.5	159.0	1900	82.5	75.8	76.0	68.2	67.0	194.0
1890	88.8	91.4	89.5	85.5	80.0	187.0	1901	81.5	81.1	77.2	71.4	61.4	169.0
1891	85.7	88.6	88.9	82.7	75.7	179.4	1902	95.1	84.7	81.9	64.0	58.3	188.5
1892	85.9	86.9	82.3	76.8	73.3	205.0	1903	74.1	77.1	79.7	81.2	65.1	174.5
1893	85.6	82.7	80.4	73.4	70.7	149.0	1904	83.0	88.0	91.6	84.1	75.8	204.9
1894	88.3	89.6	91.8	85.9	82.7	192.0	1905	77.2	77.0	74.9	72.1	71.2	186.1
1895	81.0	82.3	77.9	70.8	65.1	156.0	1906	84.6	83.3	82.9	77.3	71.6	202.5
1896	97.2	92.5	80.1	64.2	60.7	124.1	1907	70.5	72.0	75.0	72.7	67.7	178.3
1897	83.5	86.0	86.9	78.3	70.0	181.9	1908	79.7	81.2	83.0	76.1	69.7	194.9
1898	89.0	91.2	91.2	79.8	75.4	219.0							

COTTON CROP IN THE UNITED STATES, 1790-1908.

Intelligent use of the following table depends upon observing these explanations:

Year.—The year mentioned is, for production, that of planting and growth; but ginning continues into the following calendar year. When, in want of figures for production, a commercial crop is taken, this represents the trade movement beginning September 1 of the growth year and ending August 31 of the following year. The year for exports and imports begins October 1 of the growth year for the period 1790–1842 (1842 is a nine-month year); July 1 for 1843–1866 (1866 is a fourteen-month year); and September 1 for 1867 and subsequently; except that the average price of exports per pound given for the years 1791–1800 (average for following and nearly coincident calendar years adopted) is derived from a report of Secretary of Treasury Woodbury (Ex. Doc. No. 146, 24th Cong., 1st sess.).

Production—number of running bales.—1790–1834 and 1839, production, total net weight in pounds divided by net weight per bale; 1835–1838, 1840–1848, 1850–1858, 1860, 1865–1868, 1870–1878, 1880–1888, 1890–1898, commercial crop, Latham, Alexander & Company's Cotton Movement and Fluctuation; 1849, 1859, 1869, 1879, 1889, 1899, and subsequently, production, Census; 1861–1864, commercial crop, Production and Price of Cotton for One Hundred Years, by James L. Watkins, Bulletin No. 9, Bureau of Statistics, United States Department of Agriculture. Linters included, 1899 and subsequently. Number of running bales of linters, 1899, 114,544; 1900, 143,500; 1901, 166,026; 1902, 196,223; 1903, 195,752; 1904, 245,973; 1905, 230,497; 1906, 322,064; 1907, 268,060; 1908, 346,126.

Production—500-pound bales.—Linters included, 1899 and subsequently, with same number of bales as above for 1899–1902; 500-pound bales in 1903, 194,486; 1904, 241,942; 1905, 229,539; 1906, 321,689; 1907, 268,282; 1908, 345,507.

Production—net weight per bale.—1790–1898, Bulletin No. 9, above, and Latham, Alexander & Company, above, except that for the census crops of 1849, 1859, and 1869, the equivalent 400-pound bale, net lint, computed for the census, is adopted; 1899 and subsequently, Census. Linters not included.

Production—total net weight.—1790–1834, production, report of Secretary Woodbury, above; 1839, production, Census; 1835–1838, 1840–1848, 1850–1858, 1860–1868, 1870–1878, 1880–1888, 1890–1898, commercial crop, and 1849, 1859, 1869, 1879, 1889, 1899 and subsequently, production, number of bales multiplied by average net weight per bale. Linters not included.

Production—per acre.—1868–1878, 1880–1888, 1890–1898, 1900–1908, Bureau of Statistics, United States Department of Agriculture; 1879, 1889, 1899, Census.

Price per pound of lint.—1869–1898, and 1907 and subsequently, farm price, December 1, Bureau of Statistics, Department of Agriculture, specific inquiry; 1899, Census, total farm value divided by total net weight; 1900–1901, no information; 1902–1906, Census, New Orleans Cotton Exchange value for upland cotton, computed by multiplying total net weight by mean exchange price for estimated average grade, and Charleston and Savannah Cotton Exchange value for sea-island cotton. Linters not included.

Total value of lint.—Total net weight multiplied by price per pound, except for 1899, Census. Linters not included, because included in value of seed, which was in total as follows for the only years for which ascertainable: At the farm, 1899, $46,950,575; at the mill, 1902, $80,209,194; 1903, $84,049,406; 1904, $90,931,250; 1905, $75,464,515; 1906, $81,335,699; 1907, $87,325,575; 1908, $92,416,128.

Domestic exports.—Including reexports, 1790–1800, not including reexports, 1801–1819, American State Papers; 1820–1906, Bureau of Statistics, Department of Commerce and Labor. Civil war, 1860–1864, and deficient record of exports. Linters included, 1897 and subsequently; uncertain whether included before 1897 and after this class of cotton first appeared in trade, soon after 1870.

Net imports.—Imports, including reexports, 1790–1800, not including reexports, 1801–1818, American State Papers; 1819, Report of Secretary Woodbury, above; 1820 and subsequently, Bureau of Statistics, Department of Commerce and Labor; except that the imports given for the years 1791–1793 are for the following calendar years, being nearly coincident with the commercial crop years, and the report of imports for 1857–1860 is wanting or only fragmentary as to quantity.

Linters.—1899 and subsequently, included in production of running bales and equivalent 500-pound bales, and in consumption. Included in domestic exports, as explained above.

Consumption.—Linters included, 1899 and subsequently. No account taken of stocks at beginning and end of year. The figures are from the formula of production plus net imports minus domestic exports, and do not stand for actual consumption

for any certain year, concerning which see annual bulletins of Bureau of the Census concerning supply and distribution of cotton.

Consumption of unmanufactured fiber—per capita.—Weighted averages: 1790–1795, 1.12 pounds; 1796–1800, 2.05 pounds; 1801–1805, 4.58 pounds; 1806–1810, 3.98 pounds; 1811–1815, 4.56 pounds; 1816–1820, 4.55 pounds; 1821–1825, 4.54 pounds; 1826–1830, 6.13 pounds; 1831–1835, 6.05 pounds; 1836–1840, 7.08 pounds; 1841–1845, 10.98 pounds; 1846–1850, 11.78 pounds; 1851–1855, 13.17 pounds; 1856–1860, 21.65 pounds; 1861–1865, 22.38 pounds; 1866–1870, 10.15 pounds; 1871–1875, 12.88 pounds; 1876–1880, 15.43 pounds; 1881–1885, 17.36 pounds; 1886–1890, 19.00 pounds; 1891–1895, 19.10 pounds; 1896–1900, 22.45 pounds; 1901–1905, 23.15 pounds.

Five-year averages.—The percentages of production retained for consumption and the per capita consumption of unmanufactured fiber are weighted averages; net weight per bale, yield per acre, and price per pound are means.

Gold values.—All values have been reduced to gold for 1862–1878.

Bureau of the Census.—In the preparation of the following table the Bureau of Statistics of the Department of Agriculture has been favored with the cooperation of the Bureau of the Census of the Department of Commerce and Labor.

Production, value, domestic exports, net imports, and consumption of cotton for the United States, 1790–1908.

Year.	Production.					Value of lint at farm or exchange.		Domestic exports, beginning in year mentioned.				Net imports, beginning in year mentioned.			Retained and received for consumption, in 500-pound bales, gross weight.	
	Running bales, counting round as half bales.	Equivalent 500-pound bales, gross weight.	Net weight of lint per bale.	Total net weight of lint.	Average yield per acre.	Price per pound.	Total value.	Gross weight.	Equivalent 500-pound bales, gross weight.	Export value.	Export price per pound, gross weight.	Net weight.	Equivalent 500-pound bales, gross weight.	Value.	Quantity.	Per cent of production.
	Number.	*Number.*	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*	*Pounds.*	*Number.*	*Dollars.*	*Cents.*	*Pounds.*	*No.*	*Dollars.*	*Number.*	*Per ct.*
1790	6,667	3,138	225	1,500,000				189,316	379	47,329	25.0	333,124	697	82,884	3,456	110.1
1791	8,889	4,184	225	2,000,000				138,328	277		29.0	531,743	1,112		5,019	120.0
1792	13,333	6,276	225	3,000,000				548,550	1,097		32.0	2,630,239	5,503		10,682	170.2
1793	22,222	10,460	225	5,000,000				1,782,310	3,565		33.0	2,450,673	5,127		12,022	114.9
1794	35,556	16,736	225	8,000,000				4,707,225	9,414		36.5	4,106,973	8,592		15,914	95.1
1795	35,556	16,736	225	8,000,000				6,106,729	12,213		36.5	4,176,347	8,737		13,260	79.2
1796	44,444	20,921	225	10,000,000				3,788,429	7,577		34.0	3,506,577	7,336		20,680	98.8
1797	48,889	23,013	225	11,000,000				9,360,005	18,720		39.0	3,709,863	7,761		12,054	52.4
1798	66,667	31,381	225	15,000,000				9,532,263	19,065		44.0	3,600,297	7,532		19,848	63.2
1799	88,889	41,841	225	20,000,000				17,789,803	35,580		28.0	4,239,987	8,870		15,131	36.2
1800	153,509	73,222	228	35,000,000				20,911,201	41,822		44.0	4,156,926	8,696		40,960	54.8
1801	210,526	100,418	228	48,000,000				23,884,023	47,768	5,250,000	19.1	a 81,203	a 170	a 20,038	52,480	52.3
1802	231,092	115,063	238	55,000,000				37,712,079	75,424	7,920,000	19.3	a 551,044	a 1,153	a 137,375	38,486	33.4
1803	222,222	125,523	270	60,000,000				35,034,175	70,068	7,650,000	20.1	87,287	183	21,788	55,638	44.3
1804	261,044	135,983	249	65,000,000				38,390,087	76,780	9,445,000	24.6	218,137	456		59,659	43.9
1805	304,348	146,444	230	70,000,000				35,657,465	71,315	8,332,000	23.4	459,247	961		76,090	52.0
1806	285,714	167,364	280	80,000,000				63,944,459	127,889	14,232,000	22.3	709,592	1,485		40,960	24.5
1807	289,855	167,364	276	80,000,000				10,630,445	21,261	2,221,000	20.9	3,009,985	6,297		152,400	91.1
1808	334,821	156,904	224	75,000,000				50,990,255	101,981	8,515,000	16.7	a 765,367	a 1,601		53,322	34.0
1809	328,000	171,548	250	82,000,000				93,261,462	186,523	15,108,000	16.2	a 267,515	a 560		b 15,535	
1810	286,195	177,824	297	85,000,000				62,058,236	124,116	9,652,000	15.6	206,040	431		54,139	30.4
1811	325,203	167,364	246	80,000,000				28,887,377	57,775	3,080,000	10.7	428,906	897		110,486	66.0
1812	304,878	156,904	246	75,000,000				19,110,016	38,220	2,324,000	12.2	1,497,399	3,133		121,817	77.6
1813	304,878	156,904	246	75,000,000				17,729,007	35,458	2,683,000	15.1	48,366	101		121,547	77.5
1814	254,545	146,444	275	70,000,000				82,998,747	165,997	17,529,000	21.1	a 127,175	a 266		b 19,821	
1815	369,004	209,205	271	100,000,000				81,947,116	163,894	24,106,000	29.4	a 21,122	a 44		45,267	21.6
1816	439,716	259,414	282	124,000,000				85,649,328	171,299	22,627,614	26.4	978,781	2,048		90,163	34.8
1817	465,950	271,967	279	130,000,000				92,471,178	184,942	31,334,258	33.2	1,474,987	3,086		90,111	33.1

1818	446,429	261,506	280	125,000,000				87,997,045	175,994	21,081,769	24.0	a 2,129,202	a 4,454		81,058	31.0
1819	632,576	349,372	264	167,000,000				127,860,152	255,720	22,308,667	17.4	a 2,184,772	a 4,571		89,081	25.5
1820	575,540	334,728	278	160,000,000				124,893,405	249,787	20,157,484	16.1	204,286	427	36,331	85,368	25.5
1821	636,042	376,569	283	180,000,000				144,675,095	289,350	24,035,058	16.6	a 93,677	a 196	a 26,777	87,023	23.1
1822	704,698	439,331	298	210,000,000				173,723,270	347,447	20,445,520	11.8	52,639	110	16,109	91,994	20.9
1823	656,028	387,029	282	185,000,000				142,369,663	284,739	21,947,401	15.4	445,601	932	71,075	103,222	26.7
1824	751,748	449,791	286	215,000,000				176,449,907	352,900	36,846,649	20.9	12,642	26	a 10,222	96,917	21.5
1825	817,308	533,473	312	255,000,000				204,535,415	409,071	25,025,214	12.2	37,995	79	18,914	124,481	23.3
1826	1,057,402	732,218	331	350,000,000				294,310,115	588,620	29,359,545	10.0	35,469	74	4,159	143,672	19.6
1827	805,970	564,854	335	270,000,000				210,590,463	421,181	22,487,229	10.7	285,272	597	34,926	144,270	25.5
1828	953,079	679,916	341	325,000,000				264,837,186	529,674	26,575,311	10.0	a 18,996	a 40	3,371	150,202	22.1
1829	1,076,696	763,598	339	365,000,000				298,459,102	596,918	29,674,883	9.9	180,530	378	11,511	167,058	21.9
1830	1,026,393	732,218	341	350,000,000				276,979,784	553,960	25,289,492	9.1	10,447	22	6,198	178,280	24.3
1831	1,069,444	805,439	360	385,000,000				322,215,122	644,430	31,724,682	9.8	a 10,289	a 22	15,988	160,987	20.0
1832	1,114,286	815,900	350	390,000,000				324,698,604	649,397	36,191,105	11.1	33,131	69	a 1,600	166,572	20.4
1833	1,225,895	930,962	363	445,000,000				384,717,907	769,436	49,448,402	12.9	147,265	308	2,161	161,834	17.4
1834	1,253,406	962,343	367	460,000,000				387,358,992	774,718	64,961,302	16.8	752,439	1,574	66,456	189,199	19.7
1835	1,360,725	1,061,821	373	507,550,425				423,631,307	847,263	71,284,925	16.8	204,277	427	30,864	214,985	20.2
1836	1,423,930	1,129,016	379	539,669,470				444,211,537	888,423	63,240,102	14.2	a 243,729	a 510	a 24,721	240,083	21.3
1837	1,801,497	1,428,384	379	682,767,363				595,952,297	1,191,905	61,556,811	10.3	169,558	355	30,755	236,834	16.6
1838	1,360,532	1,092,980	384	522,444,288				413,624,212	827,248	61,238,982	14.8	152,638	319	a 28,928	265,051	24.3
1839	2,063,915	1,653,722	383	790,479,445				743,941,061	1,487,882	63,870,307	8.6	141,808	297	23,528	166,137	10.0
1840	1,634,954	1,347,640	394	644,171,876				530,204,100	1,060,408	54,330,341	10.2	578,290	1,210	36,102	288,442	21.4
1841	1,683,574	1,398,282	397	668,378,878				584,717,017	1,169,434	47,593,464	8.1	51,216	107	a 15,005	228,955	16.4
1842	2,378,875	2,035,481	409	972,959,875				792,297,106	1,584,594	49,119,806	6.2	877,191	1,835	32,602	452,722	22.2
1843	2,030,409	1,750,060	412	836,528,508				663,633,455	1,327,267	54,063,501	8.1	247,272	517	a 119,959	423,310	24.2
1844	2,394,503	2,078,910	415	993,718,745				872,905,996	1,745,812	51,739,643	5.9	a 325,038	a 680	a 145,569	332,418	16.0
1845	2,100,537	1,806,110	411	863,320,707				547,558,055	1,095,116	42,767,341	7.8	184,674	386	a 23,674	711,380	39.4
1846	1,778,651	1,603,763	431	766,598,581				527,219,958	1,054,440	53,415,848	10.1	58,380	122	4,099	549,445	34.3
1847	2,439,786	2,128,433	417	1,017,390,762				814,274,431	1,628,549	61,998,294	7.6	266,741	558	2,087	500,442	23.5
1848	2,866,938	2,615,031	436	1,249,984,968				1,026,602,269	2,053,204	66,396,967	6.5	10,378	22	104	561,849	21.5
1849	2,469,093	2,066,187	400	987,637,200				635,381,604	1,270,763	71,984,616	11.3	231,978	485	6,897	795,909	38.5
1850	2,454,442	2,136,083	416	1,021,047,872				927,237,089	1,854,474	112,315,317	12.1	157,757	330	11,281	281,939	13.2
1851	3,126,310	2,799,290	428	1,338,060,680				1,093,230,639	2,186,461	87,965,732	8.0	244,548	512	12,521	613,341	21.9
1852	3,416,214	3,130,338	438	1,496,301,732				1,111,570,370	2,223,141	109,456,404	9.8	680,106	1,423	28,053	908,620	29.0
1853	3,074,979	2,766,194	430	1,322,240,970				987,833,106	1,975,666	93,596,220	9.5	545,210	1,141	31,318	791,669	28.6
1854	2,982,634	2,708,082	434	1,294,463,156				1,008,424,601	2,016,849	88,143,844	8.7	2,115,367	4,425	131,457	695,658	25.7
1855	3,665,557	3,220,782	420	1,539,533,940				1,351,431,701	2,702,863	128,382,351	9.5	1,096,841	2,295	71,335	520,214	16.2
1856	3,093,737	2,873,680	444	1,373,619,228				1,048,282,475	2,096,565	131,575,859	12.6	802,233	1,678	62,172	778,793	27.1
1857	3,257,339	3,012,016	442	1,439,743,838				1,118,624,012	2,237,248	131,386,661	11.7			41,356	774,768	25.7
1858	4,018,914	3,758,273	447	1,796,454,558				1,386,468,562	2,772,937	161,434,923	11.6			33,137	985,336	26.2
1859	5,387,052	4,507,993	400	2,154,820,800				1,767,686,338	3,535,373	191,806,555	10.9			130,288	972,620	21.6
1860	3,849,469	3,841,416	477	1,836,196,713				307,516,099	615,032	34,051,483	11.1			58,448	3,226,384	84.0

a Excess of foreign exports over total imports.

b Excess of domestic exports over production and net imports.

Production, value, domestic exports, net imports, and consumption of cotton for the United States, 1790–1908—Continued.

Year.	Production.					Value of lint at farm or exchange.		Domestic exports, beginning in year mentioned.				Net imports, beginning in year mentioned.			Retained and received for consumption, in 500-pound bales, gross weight.	
	Running bales, counting round as half bales.	Equivalent 500-pound bales, gross weight.	Net weight of lint per bale.	Total net weight of lint.	Average yield per acre.	Price per pound.	Total value.	Gross weight	Equivalent 500-pound bales, gross weight.	Export value.	Export price per pound, gross weight.	Net weight.	Equivalent 500-pound bales, gross weight.	Value.	Quantity.	Per cent of production.
	Number.	*Number.*	*Pounds*	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*	*Pounds.*	*Number.*	*Dollars.*	*Cents.*	*Pounds.*	*No.*	*Dollars.*	*Number.*	*Per ct.*
1861	4,500,000	4,490,586	477	2,146,500,000	....	....	....	5,064 564	10,129	1,162,411	22.9	29,567,187	61,731	6,501,482	4,542,188	101.1
1862	1,600,000	1,596,653	477	763,200,000	....	....	....	11,384,986	22,770	4,849,603	42.6	32,358,232	67,695	9,747,599	1,641,578	102.8
1863	450,000	449,059	477	214,650,000	....	....	....	11,993,911	23,988	6,333,347	52.8	25,049,722	52,405	7,782,961	477,476	106.3
1864	300,000	299,372	477	143,100,000	....	....	....	8,894,374	17,789	3,384,018	38.1	32,885,584	68,798	12,932,280	350,381	117.0
1865	2,269,316	2,093,658	441	1,000,768,356	....	....	....	650,572,829	1,301,146	200,346,279	30.8	4,933,681	10,322	859,322	802,834	38.3
1866	2,097,254	1,948,077	444	931,180,776	....	....	....	700,848,516	1,401,697	149,818,351	21.4	*a* 494,835	*a* 1,035	216,041	545,345	28.0
1867	2,519,554	2,345,610	445	1,121,201,530	....	....	....	751,378,343	1,502,756	103,371,304	13.7	164,899	345	53,783	843,199	35.9
1868	2,366,467	2,198,141	444	1,050,711,348	160.7	....	....	650,224,486	1,300,449	119,671,438	18.6	894,076	1,870	269,855	899,562	40.9
1869	3,011,996	2,520,499	400	1,204,798,400	178.0	16.5	198,791,736	993,854,009	1,987,708	188,322,906	19.5	1,446,413	3,026	252,178	535,817	21.3
1870	4,352,317	4,024,527	442	1,923,724,114	236.0	12.1	232,770,618	1.461,378,310	2,922,757	192,212,480	13.3	861,042	1,802	150,292	1,103,572	27.4
1871	2,974,351	2,756,564	443	1,317,637,493	195.3	17.9	235,857,111	912,468,397	1,824,937	159,924,901	17.5	3,046,805	6,374	584,058	938,001	34.0
1872	3,930,508	3,650,932	444	1,745,145,552	191.4	16.5	287,949,016	1,235,294,963	2,470,590	203,073,651	16.4	4,787,635	10,016	855,638	1,190,358	32.6
1873	4,170,388	3,873,750	444	1,851,652,272	208.9	14.1	261,082,970	1,341,315,340	2,682,631	185,179,520	14.6	1,692,691	3,541	325,259	1,194,660	30.8
1874	3,832,991	3,528,276	440	1,686,516,040	198.0	13.0	219,247,085	1,252,058,889	2,504,118	167,726,380	13.3	1,808,594	3,784	351,302	1,027,942	29.1
1875	4,632,313	4,302,818	444	2,056,746,972	178.6	11.1	228,298,914	1,518,825,111	3,037,650	171,396,873	11.3	2,150,171	4,498	331,474	1,269,666	29.5
1876	4,474,069	4,118,390	440	1,968,590,360	....	9.9	194,890,446	1,419,709,173	2,839,418	155,521,838	11.1	2,309,632	4,832	354,406	1,283,804	31.2
1877	4,773,865	4,494,224	450	2,148,239,250	....	10.5	225,565,121	1,598,719,266	3,197,439	174,657,633	11.0	2,411,973	5,046	398,761	1,301,831	29.0
1878	5,074,155	4,745,078	447	2,268,147,285	191.4	8.2	185,988,077	1,645,083,172	3,290,167	163,805,068	10.0	2,413,644	5,049	420,410	1,459,960	30.8
1879	5,755,359	5,466,387	454	2,612,932,986	180.0	10.2	266,519,165	1,871,376,133	3,742,752	217,365,305	11.6	3,622,164	7,578	589,018	1,731,213	31.7
1880	6,605,750	6,356,998	460	3,038,645,000	184.5	9.8	297,787,210	2,227,747,731	4,453,495	251,402,569	11.3	2,603,930	5,447	470,620	1,908,950	30.0
1881	5,456,048	5,136,447	450	2,455,221,600	155.0	10.0	245,522,160	1,688,260,547	3,376,521	194,649,437	11.5	1,558,855	3,261	431,062	1,763,187	34.3
1882	6,949,756	6,833,442	470	3,266,385,320	185.7	9.9	323,372,147	2,295,665,741	4,591,331	246,883,483	10.8	2,254,261	4,716	506,499	2,246,827	32.9
1883	5,713,200	5,521,963	462	2,639,498,400	164.8	9.0	237,554,856	1,866,684,497	3,733,369	197,984,295	10.6	5,376,152	11,247	1,109,056	1,799,841	32.6
1884	5,706,165	5,491,288	460	2,624,835,900	....	9.2	241,484,903	1,865,084,912	3,730,170	198,744,802	10.7	3,415,049	7,144	623,977	1,768,262	32.2
1885	6,575,691	6,369,341	463	3,044,544,933	....	8.5	258,786,319	2,100,323,244	4,200,647	208,429,904	9.9	3,952,936	8,270	530,146	2,176,964	34.2
1886	6,505,087	6,314,561	464	3,018,360,368	169.5	8.1	247,140,771	2,150,770,791	4,301,542	204,740,804	9.5	3,609,874	7,552	484,648	2,020,571	32.0
1887	7,046,833	6,884,667	467	3,290,871,011	182.7	8.5	279,724,037	2,259,626,754	4,519,254	222,805,494	9.9	5,727,746	11,983	800,038	2,377,396	34.5
1888	6,938,290	6,923,775	477	3,309,564,330	180.4	8.5	281,312,968	2,365,095,768	4,730,192	235,898,233	10.0	7,305,653	15,284	1,117,961	2,208,867	31.9
1889	7,472,511	7,472,511	478	3,571,860,258	177.0	8.3	296,464,401	2,464,460,578	4,928,921	250,571,336	10.2	8,763,738	18,334	1,402,251	2,561,924	34.3
1890	8,652,597	8,562,089	473	4,092,678,381	187.0	8.6	351,970,341	2,925,109,652	5,850,219	291,490,029	10.0	21,787,371	45,580	2,890,394	2,757,450	32.2

1891......	9,035,379	8,940,867	473	4,273,734,267	179.4	7.3	311,982,601	2,948,400,103	5,896,800	258,628,371	8.8	30,780,183	64,394	3,405,229	3,108,461	34.8
1892......	6,700,365	6,658,313	475	3,182,673,375	205.0	8.4	267,344,564	2,242,625,388	4,485,251	190,787,234	8.5	40,981,491	85,735	4,396,692	2,258,797	33.9
1893......	7,549,817	7,486,639	474	3,578,613,258	149.0	7.0	250,502,928	2,653,647,372	5,307,295	208,168,419	7.8	28,394,817	59,405	3,023,113	2,238,749	29.9
1894......	9,901,251	10,025,534	484	4,792,205,484	192.0	4.6	220,441,452	3,480,686,212	6,961,372	200,747,308	5.8	47,513,540	99,399	4,614,472	3,163,561	31.6
1895......	7,157,346	7,142,372	477	3,414,054,042	156.0	7.6	259,468,107	2,380,752,407	4,761,505	194,996,401	8.2	53,536,593	112,001	6,388,991	2,492,868	34.9
1896......	8,757,964	8,739,642	477	4,177,548,828	124.1	6.6	275,718,223	3,063,092,199	6,126,185	227,935,158	7.4	54,832,291	114,712	6,165,576	2,728,169	31.2
1897......	11,199,994	11,293,718	482	5,398,397,108	181.9	6.6	356,294,209	3,919,733,592	7,839,467	233,378,492	6.0	50,573,333	105,802	4,736,169	3,560,053	31.5
1898......	11,274,840	11,534,303	489	5,513,396,760	219.0	5.7	314,263,615	3,827,640,592	7,655,281	212,630,343	5.6	49,340,705	103,223	5,002,387	3,982,245	34.5
1899......	9,507,786	9,459,935	476	4,467,096,999	184.0	7.24	323,758,171	3,110,770,454	6,221,541	246,934,387	7.9	64,423,955	134,778	7,709,490	3,373,172	35.7
1900......	10,245,602	10,266,527	480	4,846,471,000	194.0			3,430,458,408	6,860,917	319,587,792	9.3	55,739,473	116,610	7,831,882	3,522,220	34.3
1901......	9,478,546	9,675,771	489	4,550,949,999	169.0			3,464,348,519	6,928,697	286,475,568	8.3	90,858,111	190,080	10,840,849	2,937,154	30.4
1902......	10,784,473	10,827,168	481	5,091,640,748	188.5	8.28	421,687,941	3,480,440,015	6,960,880	311,682,217	9.0	71,275,955	149,113	10,569,459	4,015,401	37.1
1903......	10,015,721	10,045,615	480	4,716,591,371	174.5	12.22	576,499,824	3,145,122,483	6,290,245	376,724,537	12.0	47,942,319	100,298	8,384,804	3,855,668	38.4
1904......	13,697,310	13,679,954	478	6,426,697,828	204.9	8.73	561,100,386	4,559,806,854	9,119,614	404,396,821	8.9	62,227,128	130,182	9,576,593	4,690,522	34.3
1905......	10,725,602	10,804,556	482	5,060,205,128	186.1	11.00	556,833,818	3,487,746,773	6,975,494	385,159,047	11.0	63,795,797	133,464	9,901,114	3,962,526	36.7
1906......	13,305,265	13,595,498	490	6,354,107,861	202.5	10.08	640,311,538	4,412,618,231	8,825,236	472,088,260	10.7	101,366,364	212,061	20,039,236	4,982,323	36.6
1907......	11,325,882	11,375,461	480	5,312,948,816	178.3	10.4	552,546,677	3,889,754,147	7,779,508	443,407,627	11.4	70,434,763	147,353	13,757,427	3,743,306	32.9
1908......	13,432,131	13,587,306	484	6,336,072,211	194.9	8.7	551,238,282									
Average:																
1790–1795	20,370	9,588	225	4,583,333				2,245,410	4,491		32.0	2,371,516	4,961		10,058	104.9
1796–1800	80,480	38,076	226	18,200,000				12,276,340	24,553		37.8	3,842,730	8,039		21,562	56.6
1801–1805	245,846	124,686	243	59,600,000				34,135,566	68,271	7,719,400	21.3	26,485	55		56,470	45.3
1806–1810	304,917	168,201	265	80,400,000				56,176,971	112,354	9,945,600	18.3	578,547	1,210		57,057	33.9
1811–1815	311,702	167,364	257	80,000,000				46,134,453	92,269	9,944,400	17.7	365,275	764		75,859	45.3
1816–1820	512,042	295,397	277	141,200,000				103,774,222	207,548	23,501,958	23.4	a 331,184	b 693		87,156	29.5
1821–1825	713,165	437,239	292	209,000,000				168,350,670	336,701	25,659,968	15.4	91,040	190	13,820	100,728	23.0
1826–1830	983,908	694,561	337	332,000,000				269,035,330	538,071	26,677,292	9.9	98,544	206	12,033	156,696	22.6
1831–1835	1,204,751	915,293	363	437,510,085				368,524,386	737,049	50,722,083	13.5	225,365	471	22,774	178,715	19.5
1836–1840	1,656,966	1,330,348	384	635,906,488				545,586,641	1,091,173	60,847,309	11.6	159,713	334	7,347	239,509	18.0
1841–1845	2,117,580	1,813,769	409	866,981,343				692,222,326	1,384,445	49,056,751	7.2	207,063	433	b 54,321	429,757	23.7
1846–1850	2,401,782	2,109,899	420	1,008,531,877				786,143,070	1,572,286	73,222,208	9.5	145,047	303	4,894	537,916	25.5
1851–1855	3,253,139	2,924,937	430	1,398,120,096				1,110,498,083	2,220,996	101,508,910	9.1	936,414	1,959	56,937	705,900	24.1
1856–1860	3,921,302	3,598,676	442	1,720,167,027				1,125,715,497	2,251,431	130,051,096	11.6			65,080	1,347,580	37.4
1861–1865	1,823,863	1,785,866	470	853,643,671				137,582,133	275,164	43,215,132	37.4	24,946,881	52,190	7,564,729	1,562,892	87.5
1866–1870	2,869,518	2,607,371	435	1,246,323,234				911,536,733	1,823,073	150,679,296	17.3	574,319	1,202	188,430	785,500	30.1
1871–1875	3,908,110	3,622,468	443	1,731,539,666	194.4	14.5	246,487,019	1,251,992,540	2,503,985	177,460,265	14.6	2,697,161	5,643	489,546	1,124,126	31.0
1876–1880	5,336,640	5,036,215	450	2,407,310,976		9.7	234,150,004	1,752,527,095	3,504,654	192,550,483	11.0	2,672,269	5,590	446,643	1,537,151	30.5
1881–1885	6,080,172	5,870,496	461	2,806,097,231		9.3	261,344,077	1,963,203,788	3,926,408	209,338,384	10.7	3,311,451	6,928	641,348	1,951,016	33.2
1886–1890	7,323,064	7,231,521	472	3,456,666,870	179.3	8.4	291,322,504	2,433,012,709	4,866,026	241,102,979	9.9	9,438,876	19,747	1,339,058	2,385,242	33.0
1891–1895	8,068,832	8,050,745	477	3,848,256,085	176.3	7.0	261,947,930	2,741,222,296	5,482,445	210,665,547	7.8	40,241,325	84,187	4,365,699	2,652,487	32.9
1896–1900	10,197,237	10,258,825	481	4,880,582,139	180.0			3,470,339,049	6,940,678	248,093,234	7.2	54,981,951	115,025	6,289,101	3,433,172	33.5
1901–1905	10,940,330	11,006,613	482	5,169,217,015	184.6			3,627,492,929	7,254,986	352,887,638	9.8	67,219,862	140,627	9,854,564	3,892,254	35.4

a Excess of foreign exports over total imports.

b Excess of domestic exports over production and net imports.

Closing prices of middling Upland cotton per pound, 1895–1908.

Date.	New York.		New Orleans.		Memphis.		Galveston.		Savannah.		Charleston.		Wilmington.		Norfolk.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
1895	5 9/16	9 3/8	5	9 3/16	5 1/16	8 15/16	5 1/16	9 11/16	5	8 11/16	5 1/8	8 3/4	4 1/8	9	5 1/16	9
1896	7 1/16	8 7/8	6 1/2	8 1/8	6 5/8	8 1/16	6 3/8	8 1/4	6 5/8	7 15/16	6 3/8	8	6 7/16	8	6 11/16	8 1/4
1897	5 13/16	8 1/4	5 1/4	7 13/16	5 1/4	7 13/16	5 3/8	7 11/16	5 1/8	7 3/4	5 1/8	7 3/4	5	8 1/8	5 3/8	8 1/8
1898	5 5/16	6 7/8	4 3/4	6 1/16	4 7/8	6	4 7/8	6 1/16	4 1/2	6	4 9/16	6	4 3/4	6 1/4	4 15/16	6 3/8
1899	6 1/8	7 13/16	5 3/16	7 1/2	5 3/8	7 1/2	5 7/16	7 1/2	5 1/16	7 5/16	5 1/8	7 3/8	5 3/8	7 1/2	5 3/8	7 1/2
1900	7 1/4	11	7 1/4	11 1/8	7 3/8	11	7 1/4	10	7 5/16	10 3/4	7 1/4	10 3/4	7 1/8	10 3/4	7 7/16	11
1901	7	12	7 1/4	9 11/16	7 1/8	9 5/8	7 3/8	9 11/16	7 1/8	9 5/8	7 1/8	9 7/8	7 1/8	9 1/2	7 1/4	9 11/16
1902	8 3/16	9 7/8	7 5/8	9 3/4	7	9 1/2	7 3/4	9 5/8	7 9/16	9 9/16	7 3/16	9 3/8	7 3/4	9 3/8	7 3/4	9 3/4
1903	8.85	14.10	8 7/16	13 5/8	8 1/2	13 1/2	8 5/8	13 3/8	8 3/8	13 3/8	8 1/4	13 1/2	8 1/4	12 3/4	8 5/8	13 3/4
1904	6.85	17.25	6 1/2	16 7/16	6 3/4	16 1/2	6 5/8	16	6 1/2	16 1/4	6 1/2	16	9	15 3/4	6 3/4	16 1/2
1905.																
Jan	7.00	7.35	6 5/8	7	6 3/4	7 1/16	6 3/4	7 1/16	6 5/8	7	6 5/8	6 7/8	.....	.....	6 3/4	7 1/8
Feb	7.35	8.90	7	7 11/16	7 1/8	7 7/16	7 1/2	7 13/16	7	7 11/16	6 3/4	7 1/8	6 3/4	7 1/2	7 1/8	7 7/8
Mar	7.75	8.30	7 1/4	7 11/16	7 3/8	7 11/16	7 1/2	7 13/16	7 3/8	7 13/16	7 1/4	7 3/4	7 1/4	7 5/8	7 5/8	8
Apr	7.55	8.15	7 3/8	7 5/16	7 3/8	7 9/16	7 3/8	7 11/16	7 1/8	7 9/16	7	7 5/16	7 1/4	7 1/2	7 3/8	7 7/8
May	7.85	8.85	7 1/2	8 7/16	7 5/8	8 3/4	7 5/8	8 11/16	7 1/4	8 1/2	7 1/4	8 1/4	7 1/4	8 1/4	7 5/8	8 5/8
June	8.40	10.15	8 1/4	9 9/16	8 3/8	9 13/16	8 1/4	9 5/16	8 1/8	9 5/8	7 7/8	8 5/16	8	8 5/8	8 1/4	9 3/4
July	10.00	11.40	9 3/4	11 1/8	9 13/16	11 1/16	9 7/8	11 3/16	9 5/8	10 7/8	10	10 5/8	.....	.....	9 1/4	11
Aug	10.50	11.35	10 3/8	10 9/16	10 1/8	10 5/8	10 1/2	10 11/16	10 1/4	10 11/16	10 1/4	10 5/8	.....	10 3/8	10 1/2	11
Sept	10.65	11.10	10 1/8	10 7/16	10 1/8	10 11/16	10 3/8	10 11/16	9 7/8	10 5/16	9 7/8	10 7/16	10	10 3/8	10 1/4	10 9/16
Oct	9.85	10.75	9 3/4	10 11/16	9 7/8	10 3/16	9 3/4	10 9/16	9 7/16	10 7/16	9 1/2	10 3/16	9 1/2	10 1/4	9 5/8	10 5/8
Nov	10.90	12.00	10 3/4	11 9/16	11	11 15/16	10 3/4	11 5/16	10 3/8	11 5/16	10 1/4	11 1/4	10 3/8	11 1/4	10 5/8	11 9/16
Dec	11.65	12.60	11 3/8	12 1/16	11 1/2	12 1/8	11 1/2	12	11 3/4	11 11/16	11	11 5/16	11 1/8	11 3/8	11 3/8	12
1906.																
Jan	11.35	12.25	11 1/4	11 11/16	11 1/4	11 11/16	11	11 1/16	10 7/8	11 7/16	11	11 3/8	11	11 1/4	11 1/4	11 3/4
Feb	10.80	11.45	10 5/8	10 11/16	10 3/4	11 3/16	10 3/4	11	10 3/8	10 11/16	10 1/8	10 11/16	10 1/4	10 1/2	10 5/8	11
Mar	10.95	11.80	10 1/2	11 1/16	10 3/4	11 1/4	10 3/4	11 5/16	10 3/8	11 1/8	10 1/4	11	10 1/4	11	10 1/2	11 3/16
Apr	11.55	11.90	11 1/8	11 7/16	11 1/8	11 5/16	11 1/4	11 7/16	11	11 3/16	10 7/8	11 1/8	11	11 1/4	11 1/4	11 5/8
May	11.25	12.00	11 1/8	11 7/16	11 1/2	11 7/16	11 1/8	11 9/16	11	11 5/16	11	11 3/16	11	11 3/16	11 1/4	11 7/16
June	10.80	11.30	10 7/8	11 1/16	10 3/4	11	11 1/8	11 1/16	10 3/4	11 3/4	10 5/8	10 9/16	10 3/4	10 13/16	11	11 1/4
July	10.80	11.00	10 5/8	11 1/8	10 3/4	11	10 7/8	11 1/16	10 3/4	10 11/16	.....	.....	10 3/4	10 3/4	11	11 1/16
Aug	9.80	10.90	9 3/8	10 5/16	9 5/8	10 3/4	9 1/4	10 3/16	9 3/4	10 7/8	9	9 1/4	9	10 9/16	9 3/4	11 1/16
Sept	9.60	10.00	9 3/8	9 5/16	9 3/8	9 9/16	9 1/4	9 15/16	8 7/8	9 3/16	8 3/4	9 1/4	9	9 3/16	9 3/8	9 7/16
Oct	10.25	11.40	9 11/16	11 3/16	10 1/16	11 1/2	9 7/8	11 5/16	9 5/8	10 15/16	9 7/8	11	9 1/2	11	9 15/16	11 5/16
Nov	10.10	11.40	9 5/8	11 3/16	9 7/8	11	9 7/8	11 3/16	9 3/8	10 15/16	9 1/4	10 5/8	9 5/8	10 9/16	10	11 1/4
Dec	10.45	11.25	10 1/8	11 3/8	10 1/4	11 1/16	10 1/4	11 3/8	9 3/4	10 7/16	9 1/2	10 3/16	9 5/8	10 5/8	10 1/8	11 1/4
1907.																
Jan	10.70	11.00	10 1/4	10 9/16	10 1/4	10 9/16	10 1/2	10 11/16	9 7/8	10 9/16	9 3/4	10	9 7/8	10 3/16	10 1/4	10 5/8
Feb	11.00	11.25	10 1/2	10 9/16	10 7/16	10 9/16	10 3/4	11 1/16	10 1/8	10 5/16	10	10 3/16	10 1/8	10 3/8	10 1/2	10 7/8
Mar	10.90	11.45	10 5/8	11 1/16	10 3/8	10 11/16	10 13/16	11 7/16	10 3/8	10 5/8	10 3/8	10 5/8	10 3/8	10 5/8	11	11 1/4
Apr	10.90	11.45	10 1/2	11 9/16	10 1/2	11 1/8	10 7/8	11 5/8	10 1/4	11	10 1/4	10 3/4	10 3/8	10 7/8	11	11 7/8
May	11.50	12.90	11 1/2	12 7/16	11 1/4	12 1/2	11 7/8	12 3/4	11	12 1/8	11	11 7/8	11	12 1/4	12	13 1/4
June	12.80	13.25	12 1/2	13	12 1/2	12 15/16	12 3/4	13 1/16	12 1/4	12 3/4	.....	.....	12 1/4	12 1/4	13 1/4	13 1/2
July	12.85	13.50	12 5/8	13 1/8	12 15/16	13 3/16	12 7/8	13 1/8	12 7/8	13 1/8	.....	.....	.....	.....	13 1/2	13 5/8
Aug	13.00	13.55	12 5/8	13 9/16	13	13 1/2	.....	.....	12 5/8	13 3/16	.....	.....	.....	.....	13 1/2	13 1/2
Sept	11.75	13.55	11 1/2	13 9/16	11 7/8	13 1/2	12 1/8	13 9/16	11 1/8	13 5/16	11 1/8	13	11 1/4	13	11 3/4	13 1/2
Oct	10.80	12.00	10 3/8	11 7/16	10 3/4	12	11	12 1/8	10	11 5/16	10	11 5/16	10	11 3/16	10 3/8	11 7/8
Nov	10.60	11.80	10 1/2	11 5/16	10 3/4	11 1/4	10 7/8	11 3/16	10 1/4	10 7/16	10 1/8	10 7/16	10 1/4	10 7/16	10 1/2	11 1/4
Dec	11.70	12.20	11 1/8	11 13/16	11 3/8	11 3/4	11 1/2	12	10 1/2	11 7/16	10 3/4	11 1/16	10 13/16	11 1/16	11 1/8	11 9/16
1908.																
Jan	11.30	12.25	11 3/8	12 1/4	11 1/2	12 3/8	11 3/8	12 1/4	10 9/16	11 5/8	10 5/8	11 1/2	10 13/16	11 3/4	11 1/8	12 1/4
Feb	11.35	11.85	11 3/8	11 7/8	11 5/8	11 15/16	11 3/8	11 7/8	11	11 3/8	11	11 1/4	11 1/8	11 1/2	11 5/8	12 1/8
Mar	10.40	11.65	10 1/2	11 3/8	10 3/4	11 5/8	10 1/2	11 7/16	10 1/8	11 1/8	10	11	10 1/8	11 1/4	10 3/8	11 3/4
Apr	9.90	10.50	9 13/16	10 1/2	9 3/4	10 3/4	9 3/4	10 1/2	9 3/4	10 1/8	11	11	9 3/4	10 1/8	10 1/4	10 1/2
May	10.20	11.50	9 15/16	11 1/2	10	11 5/8	10 3/8	11 3/4	9 3/4	11 1/2	9 3/4	11 1/4	9 7/8	11 1/2	10	11 5/8
June	11.30	12.20	11 3/8	11 7/8	11 1/2	11 3/4	11 9/16	11 7/8	11 1/8	11 5/8	11	11 5/8	11 1/8	11 5/8	11 1/2	12
July	10.70	11.50	10 3/8	11 3/8	10 1/2	11 3/8	10 1/4	11 3/8	10 3/8	11 1/8	10 3/8	11	10 7/8	11 1/8	11	12
Aug	9.50	10.85	9 1/8	10 3/8	9 5/8	10 1/2	9 1/8	10 7/16	9	10 1/2	9	10 1/2	Nominal.		10	11
Sept	9.30	9.60	9	9 3/16	9 1/8	9 5/8	9 3/16	9 7/16	8 3/4	9 1/8	8 3/4	9	8 7/8	9 1/16	9 1/8	9 3/8
Oct	9.00	9.45	8 3/4	9	8 7/8	9 1/8	9	9 3/16	8 1/2	8 15/16	8 1/2	8 15/16	8 1/2	8 7/8	8 3/4	9 3/8
Nov	9.25	9.55	8 7/8	9 1/16	9 1/8	9 1/4	9	9 3/16	8 3/4	9	8 3/4	8 15/16	8 3/4	8 7/8	9	9 3/16
Dec	9.10	9.35	8 11/16	8 15/16	8 3/4	9 1/8	8 3/4	9	8 1/4	8 11/16	8 1/4	8 3/4	8 1/4	8 11/16	8 3/4	9 1/16

International trade in cotton, 1903–1907.[a]

[Bales of 500 pounds, gross weight, or 478 pounds of lint, net.]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Bales.	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Brazil	Jan. 1	130,229	61,170	111,069	146,060	129,307
British India	Jan. 1	1,436,551	1,553,948	1,628,666	1,625,261	2,211,332
Egypt	Jan. 1	1,158,029	1,225,259	1,352,516	1,387,636	1,421,818
France	Jan. 1	152,127	150,462	164,814	169,840	[b] 203,533
Germany [c]	Jan. 1	177,173	189,609	158,722	181,056	269,548
Netherlands	Jan. 1	110,568	104,182	98,851	105,827	111,005
Persia	Mar. 21	56,282	71,509	81,931	91,431	[d] 91,431
Peru	Jan. 1	35,289	34,741	44,098	48,174	[d] 48,174
United States	Jan. 1	7,296,145	6,801,689	8,310,524	7,700,458	8,384,108
Other countries	....	335,073	509,160	346,327	351,881	[b] 465,265
Total	....	10,887,466	10,701,729	12,297,518	11,807,624	13,335,521

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Austria-Hungary	Jan. 1	688,041	700,062	752,110	762,887	[b] 930,705
Belgium	Jan. 1	246,879	186,228	220,252	249,285	287,095
Canada	Jan. 1	124,837	115,389	126,711	144,484	131,737
France	Jan. 1	1,167,740	967,710	1,104,700	1,124,520	[b] 1,258,194
Germany [c]	Jan. 1	1,764,002	1,836,190	1,858,054	1,895,837	2,323,684
Italy	Jan. 1	711,035	713,733	761,328	844,118	[b] 1,005,293
Japan	Jan. 1	816,657	733,849	1,184,213	842,749	1,139,993
Mexico	Jan. 1	78,817	59,670	61,384	15,670	3,820
Netherlands	Jan. 1	199,729	203,091	210,026	208,638	245,315
Russia	Jan. 1	1,061,822	908,232	791,248	757,035	[b] 819,413
Spain	Jan. 1	368,653	325,157	352,245	401,409	[b] 416,241
Sweden	Jan. 1	83,194	80,325	89,154	95,207	95,208
Switzerland	Jan. 1	109,452	113,726	110,556	109,592	118,430
United Kingdom	Jan. 1	3,113,890	3,559,028	4,017,610	3,686,006	4,302,404
United States	Jan. 1	132,209	102,529	142,982	137,415	236,292
Other countries	....	280,451	322,003	292,657	257,894	[b] 281,975
Total	....	10,947,408	10,926,922	12,075,230	11,532,746	13,595,799

[a] See "General note," p. 605.
[b] Preliminary.
[c] Not including free ports prior to March 1, 1906.
[d] Year preceding.

International trade in cotton-seed oil, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Belgium	Jan. 1	670,655	714,319	1,252,803	1,218,611	1,371,671
Egypt	Jan. 1	426,148	397,446	249,843	360,883	214,732
France	Jan. 1	394,169	213,087	511,743	602,856	[b] 590,323
Netherlands	Jan. 1	230,762	168,425	168,686	108,062	74,686
United Kingdom	Jan. 1	6,725,236	4,865,745	5,323,636	7,654,982	8,402,909
United States	Jan. 1	27,865,212	35,368,998	53,368,839	40,297,852	39,115,276
Other countries	....	11,000	1,000	38,003	4,735	[b] 4,089
Total	....	36,323,182	41,729,020	60,913,553	50,247,981	49,773,686

[a] See "General note," p. 605.   [b] Preliminary.

International trade in cotton-seed oil, 1903–1907—Continued.

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Algeria	Jan. 1	358,204	625,340	1,163,468	1,091,215	1,106,262
Australia	Jan. 1	75,799	105,630	178,797	54,094	70,339
Austria-Hungary	Jan. 1	4,253,976	4,505,589	5,499,759	5,866,528	9,248
Belgium	Jan. 1	1,450,415	1,591,592	3,037,814	2,698,477	2,680,250
Brazil	Jan. 1	923,463	840,327	759,755	947,023	1,189,064
Canada	Jan. 1	805,593	707,766	1,064,773	1,175,676	1,403,494
Egypt	Jan. 1	256,211	149,587	416,962	153,722	51,674
France	Jan. 1	5,691,156	6,130,298	11,082,265	9,859,577	[a] 9,751,644
Germany [b]	Jan. 1	11,420,314	11,347,562	16,767,840	16,203,800	15,109,019
Italy	Jan. 1	1,051,462	1,225,569	3,429,991	786,563	[a] 902,692
Malta	Apr. 1	364,105	285,903	235,683	224,712	[c] 224,712
Martinique	Jan. 1	285,034	277,114	300,232	301,430	288,452
Mexico	Jan. 1	3,479,985	4,002,908	3,960,087	3,881,825	3,809,854
Netherlands	Jan. 1	3,271,886	3,183,920	4,764,653	5,418,951	5,950,945
Senegal	Jan. 1	351,119	294,713	387,607	352,461	[c] 352,461
United Kingdom	Jan. 1	[d] 2,706,618	2,706,618	4,048,873	3,224,727	3,922,618
Uruguay	July 1	352,063	285,677	342,341	304,092	[c] 304,092
Other countries	....	541,000	699,000	792,753	3,092,742	[a] 3,375,048
Total	....	37,638,403	38,965,113	58,233,653	55,637,615	50,501,868

[a] Preliminary.
[b] Not including free ports prior to March 1, 1906.
[c] Year preceding.
[d] 1904 figures.

TOBACCO.

Tobacco crop of countries named, 1903–1907.

[Production of South America (especially Brazil) largely understated, because domestic consumption is unknown. No statistics for China, Persia, Central America (except Guatemala), West Indies (except Cuba and Porto Rico), and several less important tobacco-growing countries.]

Country.	1903.	1904.	1905.	1906.	1907.
NORTH AMERICA.					
United States:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Contiguous	815,972,000	660,461,000	633,034,000	682,429,000	698,126,000
Noncontiguous—Porto Rico [a]	5,000,000	5,000,000	6,000,000	8,000,000	13,000,000
Total United States (except Philippine Islands).	820,972,000	665,461,000	639,034,000	690,429,000	711,126,000
Canada:					
Ontario	2,423,000	3,194,000	6,500,000	7,575,000	(b)
Quebec	[c] 5,000,000	[c] 5,000,000	[a] 3,100,000	[a] 3,750,000	[a] 3,000,000
Other	[c] 107,000	[c] 107,000	[c] 107,000	[c] 107,000	[c] 107,000
Total Canada	7,530,000	8,301,000	9,707,000	11,432,000	3,107,000
Cuba	[a] 38,731,000	[a] 42,421,000	[a] 48,783,000	[a] 28,629,000	[a] 51,505,000
Guatemala	1,065,000	1,100,000	1,983,000	[d] 1,300,000	[d] 1,300,000
Mexico	29,156,000	28,880,000	40,644,000	[a] 22,750,000	[e] 22,750,000
Santo Domingo	(f)	(f)	(f)	(f)	26,400,000
Total North America	897,454,000	746,163,000	740,151,000	754,540,000	816,188,000
SOUTH AMERICA.					
Argentina	[g] 22,000,000	[d] 31,000,000	[g] 43,000,000	[d] 31,000,000	[d] 31,000,000
Bolivia [d]	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Brazil [h]	51,583,000	52,832,000	44,953,000	52,095,000	64,256,000
Chile [d]	6,000,000	6,000,000	6,000,000	6,000,000	6,000,000
Ecuador [h]	399,000	89,000	122,000	122,000	122,000
Paraguay	10,296,000	[a] 13,000,000	[d] 10,000,000	[d] 10,000,000	[d] 10,000,000
Peru [d]	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Total South America	94,778,000	107,421,000	108,575,000	103,717,000	115,878,000

[a] Unofficial estimate.
[b] Small crop—no data.
[c] Estimated from census for 1900.
[d] Average production.
[e] Year preceding.
[f] No data.
[g] Estimated from official data of acreage.
[h] Exports.

Tobacco crop of countries named, 1903–1907—Continued.

Country.	1903.	1904.	1905.	1906.	1907.
EUROPE.					
Austria-Hungary:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria	15,895,000	14,047,000	14,360,000	17,884,000	15,129,000
Hungary	134,567,000	88,768,000	103,076,000	160,616,000	135,013,000
Bosnia-Herzegovina	*a* 9,000,000	9,000,000	8,753,000	*b* 8,753,000	*b* 8,753,000
Total Austria-Hungary	159,462,000	111,815,000	126,189,000	187,253,000	158,895,000
Belgium	9,685,000	13,983,000	16,646,000	15,001,000	19,476,000
Bulgaria	18,195,000	9,940,000	8,638,000	14,171,000	*c* 14,171,000
Denmark	342,000	340,000	340,000	340,000	160,000
France	57,466,000	37,767,000	53,863,000	36,116,000	40,810,000
Germany	72,911,000	75,797,000	70,240,000	70,713,000	61,665,000
Greece	*d* 14,000,000	*d* 14,000,000	20,000,000	11,000,000	7,700,000
Italy	12,188,000	13,464,000	15,605,000	14,494,000	*c* 14,494,000
Netherlands	1,770,000	1,492,000	1,490,000	1,609,000	1,700,000
Roumania	10,113,000	3,999,000	8,694,000	9,994,000	15,554,000
Russia	222,785,000	204,298,000	214,050,000	162,020,000	226,258,000
Servia	2,268,000	2,379,000	2,086,000	2,381,000	3,208,000
Sweden	1,706,000	4,118,000	2,713,000	2,661,000	*c* 2,661,000
Turkey (including Asiatic) *e*	110,000,000	90,000,000	100,000,000	100,000,000	100,000,000
Total Europe	692,891,000	583,392,000	640,554,000	628,053,000	666,752,000
ASIA.					
British India *e*	450,000,000	450,000,000	450,000,000	450,000,000	450,000,000
Dutch East Indies:					
Borneo	163,000	56,000	*d* 300,000	*d* 300,000	*d* 300,000
Java *f*	59,274,000	44,991,000	65,316,000	67,088,000	*c* 67,088,000
Sumatra, East coast of	50,721,000	45,134,000	43,635,000	47,363,000	*c* 47,363,000
Total Dutch East Indies	110,158,000	90,181,000	109,251,000	114,751,000	114,751,000
Japanese Empire:					
Japan	95,151,000	105,853,000	89,931,000	104,575,000	*c* 104,575,000
Formosa	1,010,000	222,000	187,000	*b* 187,000	*b* 187,000
Total Japanese Empire	96,161,000	106,075,000	90,118,000	104,762,000	104,762,000
Philippine Islands *g*	35,900,000	33,100,000	38,200,000	46,800,000	40,056,000
Total Asia	692,219,000	679,356,000	687,569,000	716,313,000	709,569,000
AFRICA.					
Algeria	13,013,000	12,492,000	13,006,000	11,668,000	14,177,000
British Central Africa	*a* 60,000	60,000	*h* 199,000	*h* 413,000	583,000
Cape of Good Hope *g*	5,000,000	5,309,000	5,000,000	5,000,000	5,000,000
Mauritius	28,000	29,000	13,000	*b* 13,000	*b* 13,000
Natal	4,418,000	2,907,000	2,623,000	3,103,000	2,771,000
Orange River Colony	*a* 750,000	750,000	650,000	*b* 650,000	*b* 650,000
Total Africa	23,269,000	21,547,000	21,491,000	20,847,000	23,194,000
OCEANIA.					
Australia:					
Queensland	204,000	69,000	798,000	1,146,000	723,000
New South Wales	292,000	596,000	562,000	821,000	602,000
Victoria	87,000	95,000	125,000	157,000	*c* 157,000
Total Australia	583,000	760,000	1,485,000	2,124,000	1,482,000
Fiji	74,000	58,000	1,000	*b* 1,000	44,000
Total Oceania	657,000	818,000	1,486,000	2,125,000	1,526,000
Grand total	2,401,268,000	2,138,697,000	2,199,826,000	2,225,595,000	2,333,107,000

a Official estimate for 1904.
b Data for 1905.
c Year preceding.
d Average production.
e Unofficial estimate.
f Java reports less production than exports.
g Estimated from returns for census year.
h Exports.

Acreage, production, value, etc., of tobacco in the United States, 1900–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per pound Dec. 1.	Farm value Dec. 1.
	Acres.	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*
1900	1,046,427	778.0	814,345,341	6.6	53,661,132
1901	1,039,199	788.0	818,953,373	7.1	58,283,108
1902	1,030,734	797.3	821,823,963	7.0	57,563,510
1903	1,037,735	786.3	815,972,425	6.8	55,514,627
1904	806,409	819.0	660,460,739	8.1	53,382,959
1905	776,112	815.6	633,033,719	8.5	53,519,068
1906	796,099	857.2	682,428,530	10.0	68,232,647
1907	820,800	850.5	698,126,000	10.2	71,411,000
1908	875,425	820.2	718,061,380	10.3	74,130,185

Year.	Domestic exports of unmanufactured, fiscal year beginning July 1.	Imports of unmanufactured, fiscal year beginning July 1.	Condition of growing crop.			
			July 1.	Aug. 1.	Sept. 1.	When harvested.
	Pounds.	*Pounds.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1900	315,787,782	26,851,253	88.5	82.9	77.5	76.1
1901	301,007,365	29,428,837	86.5	72.1	78.2	81.5
1902	368,184,084	34,016,956	85.6	81.2	81.5	84.1
1903	311,971,831	31,162,636	85.1	82.9	83.4	82.3
1904	334,302,091	33,288,378	85.3	83.9	83.7	85.6
1905	312,227,202	41,125,970	87.4	84.1	85.1	85.8
1906	340,742,864	40,898,807	86.7	87.2	86.2	84.6
1907	330,812,658	35,005,131	81.3	82.8	82.5	84.8
1908	....	....	86.6	85.8	84.3	84.1

Acreage, production, and value of tobacco in the United States in 1908.

State, Territory, or Division.	Acreage.	Production.	Farm value December 1.
	Acres.	*Pounds.*	*Dollars.*
N. Hampshire	99	178,200	24,948
Vermont	200	347,000	45,110
Massachusetts	4,512	7,444,800	1,153,944
Connecticut	13,824	23,224,320	3,948,134
New York	6,177	7,257,975	689,508
Pennsylvania	29,440	39,008,000	4,095,840
Maryland	26,000	18,200,000	1,365,000
Virginia	140,000	114,100,000	10,497,200
West Virginia	6,200	4,650,000	651,000
N. Carolina	200,000	134,000,000	14,070,000
S. Carolina	29,000	25,085,000	2,508,500
Georgia	2,775	2,705,625	946,969
Florida	5,625	5,568,750	1,949,062
Ohio	50,400	33,768,000	3,545,640
Indiana	12,450	8,715,000	1,045,800
Illinois	1,500	1,132,500	96,262
Wisconsin	35,000	39,550,000	3,955,000
Missouri	2,500	2,187,500	273,438
Kentucky	240,000	195,600,000	17,799,600
Tennessee	65,000	52,000,000	4,680,000
Alabama	630	283,500	73,710
Mississippi	100	25,000	6,250
Louisiana	102	86,700	27,744
Texas	3,000	2,400,000	600,000
Arkansas	891	543,510	81,526
United States	875,425	718,061,380	74,130,185
Division: [a]			
N. Atlantic	54,252	77,460,295	9,957,484
S. Atlantic	409,600	304,309,375	31,987,731
N. Central E. of Miss. R.	99,350	83,165,500	8,642,702
N. Central W. of Miss. R.	2,500	2,187,500	273,438
S. Central	309,723	250,938,710	23,268,830
Far Western	....	....	....

[a] See note *a*, page 599.

TOBACCO CROP IN THE UNITED STATES, 1612-1908.

Intelligent use of the following table depends upon observing these explanations:

Total production.—The year mentioned is that of planting, growth, and harvest. Production derived as follows: Va. crop, 1621, 1639-1641, Hening's Statutes at Large; Va. and Md. crop, 1664, Bruce; 1691, article on tobacco, census 1900; other years prior to 1789, exports of unmanufactured tobacco, frequently stated in the source as English imports; 1790, average exports of unmanufactured and manufactured tobacco, 1789-1791, plus a per capita consumption of 5 pounds indicated by the mean of the censuses of 1840 to 1900; 1839, 1849, 1859, 1869, 1879, 1899, census; 1847, 1853, Commissioner of Patents; 1863-1868, 1870-1878, 1900-1903, 1906-1908, Bureau of Statistics, U. S. Department of Agriculture; 1880-1898, 1904, 1905, tobacco on which tax was paid by manufacturers to Commissioner of Internal Revenue, plus net exports of unmanufactured tobacco. Confederate States omitted for 1863-1865, Kentucky for 1863.

Domestic consumption, including garden crop, not included before 1790, and the garden crop, or small plot of tobacco for use of grower and his family, probably not included for 1790 and subsequently.

Production per acre.—Census average for 1869, 1879, 1899; for all other years, Bureau of Statistics, U. S. Department of Agriculture.

Total farm value.—Production multiplied by farm value per pound, except that for 1790 the production was multiplied by average export value; 1899, census.

Farm value per pound.—Before 1789 the figures stand for the general and usual plantation and local price, which was of contemporaneous record, but was not an average computed from the total value of the tobacco; 1790, average export value; 1847, 1853, Commissioner of Patents; 1849, census estimate; 1863-1896, 1900-1908, Bureau of Statistics, U. S. Department of Agriculture; 1899, census average.

Exports of domestic unmanufactured tobacco—net weight.—Exports of Va.: 1618-1620, Records of Va. Co.; 1627, Winsor; 1640, 1641, Hening's Statutes at Large; 1744-1755, Dinwiddie papers, Publ. Va. Hist. Soc. Exports of Va. and Md.: 1647, Winsor; 1688, Va. Hist. Reg. and Publ. of Md. Hist. Soc.; 1695, Va. Mag. of Hist. and Md. Arch.; 1701 (9 months beginning Nov.), Rpts. of Bd. of Trade and Plantations (in Md. Hist. Mag.); 1730, Macpherson; 1757, Jefferson. Imports into England: 1684, Harleian Manuscripts; 1697, 1698, ledgers of Bd. of Customs, London; 1699, 1700, 1702-1708, 1740, 1743, Anderson. Imports into Great Britain: 1760-1771, 1782, Macpherson; 1772-1781, Sheffield. Exports from the United States: 1786-1788, De Bow; 1789-1801, including reexports, 1802-1819, not including reexports, American State Papers; 1820 and subsequently, Bureau of Statistics, Department of Commerce and Labor.

The English trade year seems to have begun at Michaelmas (September 29) before 1698; at Christmas in 1698 and subsequently throughout the colonial period. Exports under the Confederation are assumed to refer to calendar years 1787, 1788, 1789, but are tabulated under previous years 1786, 1787, 1788. The year under the Constitution begins thus: 1789, August 1 (14-month year, partly duplicating previous year); 1790-1842, October 1 (1842 is a 9-month year); 1843 and subsequently, July 1.

The navigation laws prohibited tobacco shipments to any country of Europe except England (and, after the act of Union in 1707, Scotland), and required use of English or colonial shipping. Smuggling tended to understatement of trade movement.

Official colonial statistics of tobacco exports from British North America (including Newfoundland, Bermuda, and Bahama) during the year beginning January 5, 1770, quoted by Sheffield: To Great Britain, 84,997 hogsheads, at 2½ and 2¼ d. per pound, £904,981:14:0; to Africa, 9,300 pounds, at 2¼ d., £87:3:9; to West Indies, 3 hogsheads and 164,162 pounds, at 2¼ d., £1,569:0:4½.

Exports of domestic unmanufactured tobacco—total value.—Before 1789 net weight multiplied by the general and usual plantation and local price per pound; including reexports, 1789-1801, not including reexports, 1802-1819, American State Papers; 1820 and subsequently, Bureau of Statistics, Department of Commerce and Labor.

Exports of domestic unmanufactured tobacco—value per pound.—Before 1789 the figures stand for the general and usual plantation and local price, which was not computed from total value of tobacco; 1789 and subsequently, average export value.

NET IMPORTS, UNMANUFACTURED TOBACCO.—Total imports less reexports before 1866; 1846 is a 7-month year for imports, beginning December 1. For 1866 and subsequently, imports for consumption, except that quantities of very small imports are not reported for 1871–1875, 1877–1880. From Bureau of Statistics, Department of Commerce and Labor.

DOMESTIC EXPORTS OF MANUFACTURED TOBACCO—NET WEIGHT.—Including reexports, 1789–1801, not including reexports, 1802–1819, American State Papers; 1820 and subsequently, Bureau of Statistics, Department of Commerce and Labor. Comprise for 1868–1882, only cigars and snuff; 1883–1896, only cigars and cigarettes; 1897 and subsequently, only cigars, cigarettes, and plug.

IMPORTS OF MANUFACTURED TOBACCO—NET WEIGHT.—1789–1818, American State Papers; 1820 and subsequently, Bureau of Statistics, Department of Commerce and Labor. Fiscal years begin as follows: 1789, August 1 (14-month year); 1790, October 1; missing, October 1-December 31, 1791; original statements are for calendar years 1792, 1793, and 1794, but these are entered here on lines for 1791, 1792, and 1793; 1794 (duplicating last quarter of previous year)–1818, October 1; missing, 1819; 1820–1842 (1842 is a 9-month year), October 1; 1843 and subsequently, July 1.

REEXPORTS, OR FOREIGN EXPORTS, OF MANUFACTURED TOBACCO—NET WEIGHT.—Included in domestic exports, 1789–1801; reports begin October 1, 1802. For 1802–1818, American State Papers; 1820 and subsequently, Bureau of Statistics, Department of Commerce and Labor, except that 1847 is estimated.

NET IMPORTS, MANUFACTURED TOBACCO—NET WEIGHT.—Gross imports for 1789–1801; total imports less the reexports, 1802–1865; 1866 and subsequently, imports for consumption.

CONSUMPTION.—No account taken of stocks at beginning and end of year. The figures are from the formula of production plus net imports (imports for consumption, 1866 and subsequently) minus domestic exports, and do not stand for actual consumption for any certain year.

The computed low fraction of crop represented by domestic consumption, and the computed low per capita consumption for the three five-year averages, 1866 to 1880, are more likely due to underestimation of the crop than to underconsumption.

CONSUMPTION—PER CAPITA.—Including stems, waste, and imports, and excluding reexports and probably some of the garden crop, the indicated per capita consumption of tobacco follows: 1839, 5.65 pounds; weighted averages: 1847, 1849, 1853, 3.03 pounds; 1859, 8.27 pounds; 1866–1870, 3.07 pounds; 1871–1875, 1.78 pounds; 1876–1880, 3.65 pounds; 1881–1885, 5.34 pounds; 1886–1890, 5.12 pounds, 1891–1895, 5.14 pounds; 1896–1900, 5.85 pounds; 1901–1905, 6.01 pounds.

FIVE-YEAR AVERAGES.—The percentages of production retained for consumption and the per capita consumption are weighted averages; net weight per bale, yield per acre, and price per pound are means.

GOLD VALUE.—All values have been reduced to gold for 1661–1717, 1861–1878.

EQUIVALENTS USED.—Hogshead: 1664, 475 pounds; 1684–1701, 500 pounds; 1730, 600 pounds; 1740, 850 pounds; 1744–1757, 950 pounds; 1786–1864, 1,000 pounds. Case and bale: 1854–1864, 200 pounds. Cigars: 1,000 = 12 pounds; cigarettes: 1,000 = 3 pounds.

AUTHORITIES.—Ledgers of Imports and Exports of the Board of Customs, deposited in the Public Record Office, London; American State Papers, Records of the Virginia Company, Hening's Statutes at Large, Winsor's Narrative and Critical History of America, Harleian Manuscripts, Publications Virginia Historical Society, Virginia Historical Register, Publications Maryland Historical Society, Sheffield's Observations on the Commerce of the American States, Griffith's Early History of Maryland, Anderson's Commerce, Tatham's Tobacco, Jefferson's War of the Revolution, Pitkin's Statistical View of the United States, De Bow's Industrial Resources, Bruce's Economic History of Virginia in the Seventeenth Century, Maryland Archives, Macpherson's Annals of Commerce, Virginia Magazine of History, Maryland Historical Magazine, Commissioner of Patents, Bureau of Statistics of the Department of Commerce and Labor, Bureau of the Census, Commissioner of Internal Revenue, Bureau of Statistics of the U. S. Department of Agriculture.

Production, value, domestic exports, net imports, and consumption of tobacco for the United States, 1612–1908.

Year.	Production.		Farm value.		Fiscal year beginning in year mentioned.							Retained and received for consumption.	
					Unmanufactured.					Manufactured.			
					Domestic exports.			Net imports.					
	Total.	Per acre.	Total.	Per pound.	Net weight.	Value. Total.	Value. Per pound.	Net weight.	Value.	Domestic exports, net weight.	Net imports, net weight.	Quantity, net weight.	Per cent of production.
	Pounds.	*Pounds.*	*Dollars.*	*Cents.*	*Pounds.*	*Dollars.*	*Cents.*	*Pounds.*	*Dollars.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
1612, previous to		General cultivation by Indians east of Great Plains.											
1612		John Rolfe's garden at Jamestown, Virginia.											
1618	20,000		10,950	54.75	20,000	10,950	54.75						
1619	40,000		21,900	54.75	40,000	21,900	54.75						
1620	55,000		30,112	54.75	55,000	30,112	54.75						
1621	60,000				60,000								
1627	500,000				500,000								
1639	1,500,000		91,200	6.08	1,500,000	91,200	6.08						
1640	1,300,000		79,040	6.08	1,200,000	72,960	6.08						
1641	1,300,000				1,200,000								
1647	1,500,000		91,200	6.08	1,500,000	9',200	6.08						
1664	23,750,000		733,875	3.09	23,750,000	733,875	3.09						
1684	25,000,000		1,030,000	4.12	25,000,000	1,030,000	4.12						
1688	29,147,000		897,728	3.08	29,147,000	897,728	3.08						
1691	36,000,000				36,000,000								
1695	20,000,000		618,000	3.09	20,000,000	618,000	3.09						
1697	22,782,189		703,970	3.09	22,782,189	703,970	3.09						
1698	30,765,903		1,113,726	3.62	30,765,903	1,113,726	3.62						
1699	28,858,666		903,276	3.13	28,858,666	903,276	3.13						
1700	28,858,666				28,858,666								
1701	34,602,000				34,602,000								
1702	28,858,666				28,858,666								
1703	28,858,666		585,831	2.03	28,858,666	585,831	2.03						
1704	28,858,666				28,858,666								
1705	28,858,666				28,858,666								
1706	28,858,666				28,858,666								
1707	28,858,666				28,858,666								
1708	28,858,666				28,858,666								
1730	36,000,000		547,200	1.52	36,000,000	547,200	1.52						
1740	25,500,000				25,500,000								

Production, value, domestic exports, net imports, and consumption of tobacco for the United States, 1612–1908—Continued.

Year.	Production.		Farm value.		Fiscal year beginning in year mentioned. Unmanufactured. Domestic exports.			Unmanufactured. Net imports.		Manufactured.		Retained and received for consumption.	
	Total.	Per acre.	Total.	Per pound.	Net weight.	Value. Total.	Value. Per pound.	Net weight.	Value.	Domestic exports, net weight.	Net imports, net weight.	Quantity net weight.	Per cent of production.
	Pounds.	*Pounds.*	*Dollars.*	*Cents.*	*Pounds.*	*Dollars.*	*Cents.*	*Pounds.*	*Dollars.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
1743	40,000,000		1,216,000	3.04	40,000,000	1,216,000	3.04						
1744	40,357,000		1,638,494	4.06	40,357,000	1,638,494	4.06						
1745	38,230,000				38,230,000								
1746	39,714,000				39,714,000								
1747	44,444,000				44,444,000								
1748	45,588,000				45,588,000								
1749	46,139,000				46,139,000								
1750	44,368,000				44,368,000								
1751	45,961,000				45,961,000								
1752	56,855,000				56,855,000								
1753	48,263,000				48,263,000								
1754	45,303,000				45,303,000								
1755	27,029,000				27,029,000								
1757	66,500,000				66,500,000								
1760	71,114,167				71,114,167								
1761	71,441,924				71,441,924								
1762	96,786,922		4,413,484	4.56	96,786,922	4,413,484	4.56						
1763	80,743,537		3,681,905	4.56	80,743,537	3,681,905	4.56						
1764	82,196,158		3,337,164	4.06	82,196,158	3,337,164	4.06						
1765	75,482,676		1,532,298	2.03	75,482,676	1,532,298	2.03						
1766	68,525,982				68,525,982								
1767	68,807,139				68,807,139								
1768	69,704,893				69,704,893								
1769	78,413,391				78,413,391								
1770	107,391,329				107,391,329								
1771	95,241,937		4,343,032	4.56	95,241,937	4,343,032	4.56						
1772	100,472,007				100,472,007								
1773	97,396,688				97,396,688								
1774	101,828,617				101,828,617								
1775	14,698,400				14,698,400								

1776	2,440,947				2,440,947								
1777	11,961,527				11,961,527								
1778	17,155,895				17,155,895								
1779	17,424,810				17,424,810								
1780	13,338,968		405,505	3.04	13,338,968	405,505	3.04						
1781	9,828,069				9,828,069								
1782	19,579,031				19,579,031								
1786	90,041,000				90,041,000								
1787	88,595,000				88,595,000								
1788	88,675,000				88,675,000								
1789					118,460,000	4,349,567	3.7			15,350	5,481		
1790	130,000,000		4,420,000	3.4	101,272,000	3,469,448	3.4			96,811	5,986	28,637,175	22.0
1791					112,428,000					127,916	10,814		
1792					59,947,000					173,343	38,167		
1793					76,826,000					61,065	27,539		
1794					61,050,000					149,699	57,563		
1795					69,018,000					296,227	43,500		
1796					58,167,000					78,508	33,411		
1797					68,567,000					256,420	76,772		
1798					96,070,000					525,758	104,791		
1799					78,680,000					499,166	186,375		
1800					103,758,000					524,579	192,022		
1801					77,721,000	6,220,000	8.0			276,752	241,134		
1802					86,291,000	6,209,000	7.2			169,949	108,780		
1803					83,343,000	6,000,000	7.2			298,139	153,609		
1804					71,252,000	6,341,000	8.9			428,460	23,413		
1805					83,186,000	6,572,000	7.9			381,733	280,805		
1806					62,232,000	5,476,000	8.8			274,952	325,215		
1807					9,576,000	833,000	8.7			36,332	248,602		
1808					53,921,000	3,774,000	7.0			350,835	209,650		
1809					84,134,000	5,048,000	6.0			529,285	209,568		
1810					35,828,000	2,150,000	6.0			752,553	158,165		
1811					26,094,000	1,514,000	5.8			586,618	144,044		
1812					5,314,000	319,000	6.0			283,512	60,689		
1813					3,125,000	232,000	7.4			79,377	27,439		
1814					85,337,000	8,235,000	9.7			1,034,045	49,271		
1815					69,241,000	12,809,000	18.5			576,246	65,954		
1816					62,365,000	9,230,020	14.8			1,120,954	103,587		
1817					90,084,000	10,249,455	11.4			1,491,753	177,979		
1818					74,081,000	7,879,608	10.6			940,543	a 81,933		
1819					83,940,000	7,968,660	9.5			598,354			
1820					66,858,000	5,648,962	8.5			1,377,501	118,872		

Production, value, domestic exports, net imports, and consumption of tobacco for the United States, 1612–1908—Continued.

Year.	Production.		Farm value.		Fiscal year beginning in year mentioned.							Retained and received for consumption.	
					Unmanufactured.					Manufactured.			
					Domestic exports.			Net imports.					
						Value.							
	Total.	Per acre.	Total.	Per pound.	Net weight.	Total.	Per pound.	Net weight.	Value.	Domestic exports, net weight.	Net imports, net weight.	Quantity, net weight.	Per cent of production.
	Pounds.	*Pounds.*	*Dollars.*	*Cents.*	*Pounds.*	*Dollars.*	*Cents.*	*Pounds.*	*Dollars.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
1821					83,160,000	6,222,838	7.5			1,459,026	230,260		
1822					99,009,000	6,282,672	6.4			2,024,191	193,426		
1823					77,883,000	4,855,566	6.2			2,523,164	121,227		
1824					75,984,000	6,115,623	8.0			1,925,288	186,871		
1825					64,098,000	5,347,208	8.3			2,241,575	248,295		
1826					100,025,000	6,577,123	6.6			2,776,067	313,317		
1827					96,278,000	5,269,960	5.5			2,673,066	187,250		
1828					77,131,000	4,982,974	6.5			2,638,908	278,231		
1829					83,810,000	5,586,365	6.7			3,228,576	201,110		
1830					86,718,000	4,892,388	5.6			3,667,823	370,283		
1831					106,806,000	5,999,769	5.6			3,487,246	391,389		
1832					83,153,000	5,755,968	6.9			3,803,763	450,895		
1833					87,979,000	6,595,305	7.5			4,014,405	608,117		
1834					94,353,000	8,250,577	8.7			3,854,325	807,091		
1835					109,442,000	10,058,640	9.2			3,292,693	982,917		
1836					100,232,000	5,795,647	5.8			3,656,474	[a] 69,063		
1837					100,593,000	7,392,029	7.4			5,083,230	877,488		
1838					78,995,000	9,832,943	12.5			4,257,410	1,107,354		
1839	219,163,319				119,484,000	9,883,957	8.3			6,824,297	829,053	93,684,075	42.7
1840					147,828,000	12,576,703	8.5			7,572,197	1,099,769		
1841					158,710,000	9,540,755	6.0			4,476,882	904,498		
1842					94,454,000	4,650,979	4.9			3,424,707	329,480		
1843					163,042,000	8,397,255	5.2			6,075,546	671,331		
1844					147,168,000	7,469,819	5.1			5,357,370	756,290		
1845					147,998,000	8,478,270	5.7			6,910,777	804,638		
1846					135,762,000	7,242,086	5.3	729,900	118,632	7,881,643	806,598		
1847	220,164,000		11,008,200	5.0	130,665,000	7,551,122	5.8	3,040,586	337,985	6,734,629	1,335,466	87,140,423	39.6
1848					101,521,000	5,804,207	5.7	2,356,176	203,157	7,209,285	1,241,186		
1849	199,752,655		13,982,686	7.0	145,729,000	9,951,023	6.8	1,916,720	195,981	5,963,273	1,455,808	51,432,910	25.7
1850					95,945,000	9,219,251	9.6	3,754,633	505,063	7,272,780	2,567,692		

1851					137,097,000	10,031,283	7.3	2,637,107	425,805	8,494,628	3,740,140		
1852					159,853,000	11,319,319	7.1	4,507,425	771,439	10,601,333	3,279,055		
1853	199,000,000		19,900,000	10.0	126,107,060	10,016,046	7.9	4,685,604	698,958	10,309,439	3,753,502	71,022,667	35.7
1854					155,468,800	14,712,468	9.5	4,231,825	599,960	9,696,816	3,436,299		
1855					122,393,200	12,221,843	10.0	6,714,862	986,829	10,094,661	4,402,250		
1856					160,860,600	20,260,772	12.6	8,496,869	1,344,548	7,507,067	5,505,571		
1857					131,166,200	17,009,767	13.0	5,796,944	844,243	11,247,819	5,586,109		
1858					204,213,800	21,074,038	10.3	4,629,837	1,120,127	15,151,959	10,163,720		
1859	434,209,461				173,844,400	15,906,547	9.2	4,144,744	858,021	17,737,232	6,183,158	252,955,731	58.3
1860					168,469,000	13,784,710	8.2	2,507,694	602,444	14,865,868	2,934,244		
1861					116,723,200	12,140,476	10.4	4,459,436	1,137,915	4,110,802	390,960		
1862					118,750,200	14,399,510	12.1	1,019,991	184,640	7,070,172	358,658		
1863	163,353,082	755	24,239,609	14.8	113,384,400	14,622,538	12.9	2,648,538	468,973	8,626,507	670,041	44,660,754	27.3
1864	197,460,229	823	29,335,225	14.9	161,355,200	20,607,517	12.8	993,629	a 130,905	7,431,880	293,924	29,960,702	15.2
1865	185,316,953	784	23,348,013	12.6	190,826,248	20,972,775	11.0	a 1,219,173	a 865,138	6,623,405	1,222,688	b 12,129,185	
1866	388,128,684	746	37,398,393	9.6	184,803,065	13,910,703	7.5	2,849,240	747,355	9,698,732	591,754	197,067,881	50.8
1867	313,724,000	635	29,572,660	9.4	206,020,504	16,372,658	7.9	3,564,516	1,181,096	10,503,857	387,662	101,151,817	32.2
1868	320,982,000	751	29,822,873	9.3	181,527,630	14,942,083	8.2	4,645,366	1,604,017	36,765	506,996	144,569,967	45.0
1869	262,735,341	569	25,520,065	9.3	185,748,881	17,112,528	9.2	5,372,190	2,229,545	24,561	605,831	82,939,920	31.6
1870	250,628,000	758	24,010,018	9.6	215,667,604	17,659,134	8.2	6,517,061	2,756,206	35,920	865,192	42,306,729	16.9
1871	263,196,100	750	23,292,645	8.8	234,936,892	21,577,841	9.2	7,114,646	3,479,855	17,456	1,001,332	36,357,730	13.8
1872	342,304,000	822	31,647,817	9.2	213,995,176	19,808,453	9.3	9,100,533	5,155,152	14,776	1,031,304	138,426,485	40.4
1873	372,810,000	775	28,421,703	7.6	318,097,804	27,146,469	8.5	9,213,720	5,313,021	45,212	950,814	64,831,518	17.4
1874	178,355,000	633	21,066,515	11.8	223,901,913	22,415,439	10.0	7,539,598	4,304,224	25,926	874,148	b 37,159,093	
1875	379,347,000	679	26,453,881	6.9	218,310,265	19,963,442	9.1	7,067,100	3,855,973	19,035	789,732	168,874,532	44.5
1876	381,002,000	705	25,923,894	6.8	282,386,426	26,722,474	9.5	7,036,960	3,700,587	16,333	690,827	106,327,028	27.9
1877	460,000,000	644			253,973,193	24,207,949	8.5	7,458,356	3,911,559	38,328	723,878	184,170,713	40.0
1878	392,546,700	723	22,093,240	5.6	322,279,540	25,107,058	7.8	6,372,437	3,475,972	41,110	735,340	77,333,827	19.7
1879	472,661,157	795	22,727,524	5.8	215,910,187	16,379,107	7.6	7,186,391	3,839,130	46,879	786,790	264,677,272	56.0
1880	455,065,396	741	37,315,362	8.2	227,026,605	18,737,043	8.3	7,631,093	4,270,574	61,393	716,677	236,325,168	51.9
1881	456,705,582	696	43,843,736	9.6	223,665,980	19,067,721	8.5	9,683,245	5,272,942	57,072	904,546	243,570,321	53.3
1882	503,277,288	764	42,275,292	8.4	235,628,360	19,438,066	8.2	13,811,140	7,414,104	61,723	978,343	282,376,688	56.1
1883	451,176,211	707	40,605,859	9.0	207,157,687	17,765,760	8.6	11,075,873	5,496,778	274,416	1,080,624	255,900,605	56.7
1884	559,397,262	747	45,870,575	8.2	230,483,646	22,025,786	9.6	12,068,488	5,998,122	334,857	1,089,866	341,737,113	61.1
1885	588,461,089	748	45,311,504	7.7	292,773,890	27,158,457	9.3	14,054,516	7,021,965	406,482	1,222,864	310,558,097	52.8
1886	543,900,132	710	40,248,610	7.4	304,920,123	25,948,277	8.5	15,316,624	7,542,004	470,517	1,512,478	255,338,591	46.9
1887	484,830,133	645	51,391,994	10.6	262,682,821	21,936,684	8.4	16,507,757	8,822,018	623,251	1,539,122	239,570,940	49.4
1888	569,841,023	757	43,877,759	7.7	223,759,232	18,901,068	8.4	18,295,135	10,020,463	715,869	1,535,691	365,166,803	64.1
1889	555,054,048	702	36,633,567	6.6	255,617,026	21,479,556	8.4	21,615,532	12,570,813	836,787	1,548,912	321,734,679	58.0
1890	577,832,455	723	47,960,094	8.3	249,232,605	21,033,759	8.4	26,055,340	17,532,926	1,003,539	1,356,309	355,007,960	61.4

a Excess of foreign exports over total imports.

b Excess of domestic exports over sum of production and net imports.

Production, value, domestic exports, net imports, and consumption of tobacco for the United States, 1612–1908—Continued.

Year.	Production.		Farm value.		Fiscal year beginning in year mentioned.							Retained and received for consumption.	
					Unmanufactured.					Manufactured.			
					Domestic exports.			Net imports.					
						Value.							
	Total.	Per acre.	Total.	Per pound.	Net weight.	Total.	Per pound.	Net weight.	Value.	Domestic exports, net weight.	Net imports, net weight.	Quantity, net weight.	Per cent of production.
	Pounds.	*Pounds.*	*Dollars.*	*Cents.*	*Pounds.*	*Dollars.*	*Cents.*	*Pounds.*	*Dollars.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
1891	590,179,303	750	50,165,241	8.5	255,432,077	20,670,045	8.1	16,379,376	7,255,689	955,839	1,038,946	351,209,709	59.5
1892	587,784,776	688	55,251,769	9.4	266,083,083	22,891,899	8.6	20,145,910	9,717,558	1,266,822	996,292	311,577,073	58.1
1893	621,507,952	687	50,342,144	8.1	290,684,992	24,085,234	8.3	17,518,090	9,150,942	1,250,397	834,669	347,925,322	56.0
1894	609,975,591	777	41,478,340	6.8	300,991,930	25,798,968	8.6	20,902,168	11,553,190	1,412,364	802,678	329,276,143	54.0
1895	612,171,397	775	44,076,341	7.2	295,539,312	24,571,362	8.3	21,169,913	11,500,781	1,916,319	782,461	336,668,140	55.0
1896	632,089,413	678	37,925,365	6.0	314,931,691	24,711,446	7.8	30,827,145	16,672,239	2,787,492	773,084	345,970,459	54.7
1897	610,860,256				263,020,214	22,171,580	8.4	8,916,266	6,611,719	7,775,401	597,103	349,578,010	57.2
1898	698,532,639				283,613,122	25,467,218	9.0	10,305,662	7,279,492	12,553,130	689,048	413,361,097	59.2
1899	868,112,865	788	56,987,902	6.6	344,655,697	29,422,371	8.5	15,843,244	11,266,011	15,722,490	744,558	524,322,480	60.4
1900	814,345,341	778	53,661,132	6.6	315,787,782	27,656,475	8.8	19,198,363	12,743,994	14,147,372	825,198	504,433,748	61.9
1901	818,953,373	788	58,283,108	7.1	301,007,365	27,103,996	9.0	23,347,471	13,873,867	17,134,917	799,630	524,958,192	64.1
1902	821,823,963	797	57,563,510	7.0	368,184,084	35,250,893	9.6	28,086,233	15,015,985	11,728,588	971,887	470,969,411	57.3
1903	815,972,425	786	55,514,627	6.8	311,971,831	29,640,812	9.5	27,933,496	14,804,451	11,509,252	1,038,054	521,462,892	63.9
1904	720,804,449	819	58,385,160	8.1	334,302,091	29,800,816	8.9	31,238,590	16,666,038	13,207,666	1,166,776	405,700,058	56.3
1905	779,384,945	816	66,247,720	8.5	312,227,202	28,808,367	9.2	37,383,953	18,817,004	12,850,194	1,133,876	492,825,378	63.2
1906	682,428,530	857	68,232,647	10.0	340,742,864	33,377,398	9.8	40,483,895	25,768,938	14,024,775	1,146,218	369,291,004	54.1
1907	698,126,000	851	76,234,000	10.9	330,812,658	34,727,157	10.5	35,833,492	22,290,564	10,942,073	1,086,170	393,290,931	56.3
1908	718,061,380	820	74,130,185	10.3									
Average:													
1790-1795					80,090,167					150,844	30,595		
1796-1800					81,048,400					376,886	118,674		
1801-1805					80,358,000	6,268,400	7.8			311,007	161,548		
1806-1810					49,138,200	3,456,200	7.3			388,791	230,240		
1811-1815					37,822,200	4,621,800	9.5			511,960	69,479		
1816-1820					75,465,600	8,195,329	11.0			1,105,821			
1821-1825					80,028,600	5,764,781	7.3			2,034,649	196,016		
1826-1830					88,792,400	5,461,762	6.2			2,996,888	270,038		
1831-1835					96,346,600	7,332,052	7.6			3,690,486	644,082		
1836-1840					109,426,400	9,096,256	8.5			5,478,722	768,920		

1841-1845	......	......	......	......	142,274,400	7,707,416	5.4	......	......	5,249,056	693,247	......	......
1846-1850	......	......	......	......	121,924,400	7,953,538	6.6	2,359,603	272,164	7,012,322	1,481,350	......	......
1851-1855	......	......	......	......	140,183,800	11,660,192	8.4	4,555,365	696,598	9,839,375	3,722,249	......	......
1856-1860	......	......	......	......	167,710,800	17,607,167	10.7	5,115,218	953,877	13,301,989	6,074,560	......	......
1861-1865	......	......	......	......	140,207,850	16,548,563	11.8	1,580,484	159,097	6,772,553	587,254	......	......
1866-1870	307,239,605	692	29,264,802	9.4	194,753,537	15,999,421	8.2	4,589,675	1,703,644	4,059,967	591,487	113,607,263	37.0
1871-1875	307,202,420	732	26,176,512	8.9	241,848,410	22,182,329	9.2	8,007,119	4,421,645	24,481	929,586	74,266,234	24.2
1876-1880	432,255,051	722	......	......	266,315,190	22,230,726	8.3	7,137,047	3,839,564	40,809	730,702	173,766,801	40.2
1881-1885	511,803,486	732	43,581,393	8.6	237,941,913	21,091,158	8.8	12,138,652	6,240,784	226,910	1,055,249	286,828,564	56.0
1886-1890	546,291,558	707	44,022,405	8.1	259,248,361	21,859,749	8.4	19,558,078	11,299,447	735,981	1,498,502	307,363,796	56.3
1891-1895	604,323,804	735	48,262,767	8.0	281,746,279	23,603,502	8.4	19,223,091	9,835,632	1,360,348	891,009	341,331,277	56.5
1896-1900	724,788,103	......	......	......	304,401,701	25,885,818	8.5	17,018,136	10,914,691	10,597,177	725,798	427,533,159	59.0
1901-1905	791,387,831	801	59,198,825	7.5	325,538,515	30,120,977	9.2	29,597,949	15,835,469	13,286,123	1,022,045	483,183,187	61.1

International trade in unmanufactured tobacco, 1903-1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Algeria	Jan. 1	8,346,919	7,524,375	6,171,178	9,722,914	7,754,758
Austria-Hungary	Jan. 1	18,967,906	21,628,003	18,687,919	19,093,790	[b] 24,397,670
Brazil	Jan. 1	51,583,095	52,832,124	44,953,473	52,094,709	64,255,913
British India	Jan. 1	23,544,221	23,635,159	22,824,739	28,092,899	28,787,031
Bulgaria	Jan. 1	3,763,682	1,323,732	5,749,096	3,493,435	2,678,406
Ceylon	Jan. 1	4,151,994	4,321,624	4,617,805	4,390,497	4,425,680
Cuba	Jan. 1	41,576,034	28,191,707	32,808,058	28,568,069	16,622,028
Dutch East Indies	Jan. 1	113,201,709	123,004,373	108,081,973	160,378,243	[c] 160,378,243
Greece	Jan. 1	12,776,805	9,689,636	13,026,375	17,690,658	14,934,504
Mexico	Jan. 1	2,476,412	4,513,163	4,320,393	4,023,645	4,479,953
Netherlands	Jan. 1	4,751,225	4,855,896	4,003,120	4,345,341	5,163,992
Philippine Islands	Jan. 1	19,249,094	18,640,377	19,832,747	26,685,768	23,589,657
Russia	Jan. 1	11,203,599	12,810,474	15,937,120	18,317,207	[b] 14,156,218
Turkey[d]	Mar. 1	39,267,984	39,267,984	39,267,984	39,267,984	39,267,984
United States	Jan. 1	316,325,914	349,331,687	292,925,181	336,730,455	317,399,986
Other countries		8,621,504	4,165,963	25,906,195	25,052,718	[b] 32,576,615
Total		679,808,097	705,736,277	659,113,356	777,948,332	760,868,638

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Argentina	Jan. 1	4,420,679	6,704,152	7,081,032	8,353,648	8,689,694
Australia	Jan. 1	5,156,793	6,629,793	5,371,534	7,538,329	10,169,910
Austria-Hungary	Jan. 1	51,576,911	51,898,125	50,850,488	52,855,812	[b] 37,640,393
Belgium	Jan. 1	20,982,344	24,053,826	22,141,627	21,146,214	20,158,453
British India	Jan. 1	4,626,250	4,324,751	6,512,590	5,284,295	4,993,124
Canada	Jan. 1	12,538,535	13,744,310	14,738,578	14,821,069	17,338,976
China	Jan. 1	7,050,800	7,776,400	12,116,533	16,034,533	17,770,000
Denmark	Jan. 1	9,900,957	10,210,707	9,744,429	10,399,202	11,208,298
Egypt	Jan. 1	14,166,786	16,006,292	16,501,051	18,250,013	18,801,016
Finland	Jan. 1	9,093,316	9,437,932	8,956,123	9,548,533	9,834,354
France	Jan. 1	56,402,809	57,368,125	66,966,994	54,816,081	[b] 62,546,228
Germany [e]	Jan. 1	137,773,884	143,445,274	178,936,160	131,495,120	156,698,138
Italy	Jan. 1	40,488,103	33,430,447	28,127,670	45,918,749	[b] 43,913,866
Netherlands	Jan. 1	52,690,827	50,279,873	42,252,451	46,588,181	50,172,040
Norway	Jan. 1	3,857,030	2,854,897	2,956,905	3,487,734	3,877,092
Portugal	Jan. 1	7,970,542	8,825,499	5,388,004	4,355,601	[c] 4,355,601
Spain	Jan. 1	42,999,521	55,741,625	48,907,491	30,043,202	[b] 57,548,196
Sweden	Jan. 1	8,585,455	11,714,014	7,221,852	8,361,847	9,212,130
Switzerland	Jan. 1	15,740,119	16,528,933	16,048,105	15,747,394	17,561,357
United Kingdom	Jan. 1	79,048,808	80,857,485	82,444,539	83,766,884	87,329,290
United States	Jan. 1	32,997,923	30,603,290	33,887,947	41,726,224	34,088,288
Other countries		30,455,854	30,220,653	56,276,364	55,711,151	[b] 50,777,686
Total		648,524,246	672,656,403	723,428,467	686,249,816	734,684,136

[a] See "General note," page 605.
[b] Preliminary.
[c] Year preceding.
[d] Exports for 1900, latest available data.
[e] Not including freeports prior to March 1, 1906.

FLAXSEED.

Acreage, production, value, etc., of flaxseed in the United States, 1902-1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.	Condition of growing crop.			
						July 1.	Aug. 1.	Sept. 1.	When harvested.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1902	3,739,700	7.8	29,284,880	105.0	30,814,661				
1903	3,233,229	8.4	27,300,510	81.7	22,291,557	86.2	80.3	80.5	74.0
1904	2,263,565	10.3	23,400,534	99.3	23,228,758	86.6	78.9	85.8	87.0
1905	2,534,836	11.2	28,477,753	84.4	24,049,072	92.7	96.7	94.2	91.5
1906	2,505,927	10.2	25,576,146	101.3	25,899,165	93.2	92.2	89.0	87.4
1907	2,864,000	9.0	25,851,000	95.6	24,713,000	91.2	91.9	85.4	78.0
1908	2,679,000	9.6	25,805,000	118.4	30,577,000	92.5	86.1	82.5	81.2

Wholesale prices of flaxseed per bushel, 1895–1908.

Date.	St. Louis.		Cincinnati.		Chicago.		Milwaukee.		Duluth.	
	Prime.				No. 1.					
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1895	....	....	$0.90	$1.25	$0.89	$1.52½	$0.89½	$1.52¼	....	....
1896	....	....	.65	.90	.63¼	.99½	.63½	.93	....	....
1897	$0.68	$1.13½	.65	.85	.71½	1.22½	.75	1.22¼	$0.71½	$1.21
1898	.84	1.36½	.80	.90	.85	1.39	.88	1.39	.86½	1.35
1899	.93	1.46	.90	1.00	.96½	1.51	.99	1.52	.90	1.42
1900	1.25	1.78	1.00	1.45	1.32	1.86	1.30	1.86	1.28½	1.87
1901	1.37	1.72	1.20	1.50	1.38	1.90	1.30	1.88	1.33	1.88
1902	1.11	1.65	1.25	1.40	1.13	1.80	1.18	1.80	1.15¼	1.78
1903	.86	1.17	1.00	1.30	.89	1.24	.94	1.24	.92	1.20
1904	.92½	1.18½	1.00	1.00	.97	1.28	1.06	1.28	1.01½	1.28
					(a)		(a)			
1905.										
January	1.14	1.15	....	....	1.15	1.23	1.21	1.23	1.23	1.24
February	1.14	1.23	....	....	1.15	1.35	1.22	1.23½	1.24½	1.38½
March	1.22	1.26½	....	....	1.23	1.39½	1.35½	1.39½	1.35	1.40¾
April	1.22	1.26	....	....	1.23	1.40	1.37	1.40	1.39	1.42
May	1.22	1.29	....	....	1.25	1.47	1.39	1.47	1.40	1.48
June	1.24	1.29	....	....	1.25	1.47	1.43	1.47	1.47½	1.50
July	1.20	1.30	....	....	1.22½	1.44	1.34	1.44	1.48	1.48
August	1.04	1.30	....	....	1.01	1.35	1.12	1.35	1.30	1.48
September	.90	1.06	1.10	1.10	.92	1.12	.98	1.12	.97¼	1.30
October	.94	.97	1.10	1.10	.92	1.03	.98	1.03	.96¼	1.00
November	.94	.95	1.10	1.10	.93	1.00	.99	1.00	.98¼	1.00⅜
December	.95	1.10	1.10	1.10	.94	1.13	1.00	1.16	.98	1.16
1906.										
January	1.06	1.16	1.10	....	1.06	1.25	1.12½	1.25	1.11½	1.24
February	1.06	1.11	1.10	....	1.06	1.16½	1.10	1.17	1.10¾	1.16¼
March	1.05	1.09	1.10	....	1.04½	1.14	1.11	1.14	1.10⅜	1.17¼
April	1.08	1.11	1.10	1.12	1.06	1.16½	1.12	1.18	1.14¼	1.20
May	1.05	1.08	1.12	....	1.06½	1.17	1.12½	1.15¾	1.12½	1.18
June	1.05	1.06½	1.12	....	1.07	1.13	1.11	1.13½	1.11¼	1.14⅞
July	1.03	1.07	1.12	....	1.05	1.12½	1.05	1.12½	1.11¼	1.14¾
August	1.02	1.05	1.12	....	1.05½	1.14	1.10	1.14	1.12	1.17¾
September	.98	1.02½	1.12	....	1.03	1.13	1.08	1.14½	1.09¼	1.17½
October	1.03	1.07	1.12	....	1.04½	1.15	1.09½	1.13¼	1.11⅛	1.15⅝
November	1.08	1.17	1.12	....	1.07½	1.22	1.13	1.20½	1.14⅞	1.25⅝
December	1.15	1.19	1.12	....	1.11½	1.23½	1.17½	1.22	1.18⅜	1.22⅛
1907.										
January	1.17	1.20	1.12	....	1.11½	1.24	1.18½	1.24½	1.17⅞	1.22⅜
February	1.18½	1.21	1.12	....	1.16	1.26	1.22½	1.24½	1.20¼	1.23½
March	1.15	1.18½	1.12	....	1.13	1.24	1.19	1.23	1.17¾	1.20¾
April	1.14	1.17½	1.12	....	1.11	1.23	1.16½	1.20	1.16¼	1.21
May	1.16	1.25½	1.12	....	1.14	1.30	1.19	1.26½	1.18½	1.27¾
June	1.24½	1.27	1.12	....	1.24	1.32	1.25	1.31	1.21¼	1.29½
July	1.06	1.10	1.12	....	1.18½	1.26	1.20	1.25	1.16¼	1.23½
August	1.00	1.10	1.12	....	1.07	1.20	1.16	1.20	1.11⅝	1.20
September	1.05	1.14	1.12	....	1.13½	1.28	1.19	1.27	1.21½	1.28¼
October	1.08	1.16	1.12	....	1.11	1.36½	1.16	1.34	1.22¼	1.41½
November	1.00	1.14	1.12	....	.96	1.21½	1.07	1.19	1.06½	1.22
December	1.02	1.10	1.12	....	.99½	1.20	1.07¾	1.14	1.08¾	1.17¼
1908.										
January	1.11	1.18	1.12	....	1.09	1.22¼	1.15¼	1.20	1.14⅛	1.19
February	1.14	1.18½	1.12	....	1.06½	1.21½	1.16	1.19½	1.12¾	1.18
March	1.13	1.16	1.12	....	1.07¾	1.20½	1.17	1.20	1.14½	1.17
April	1.13½	1.17½	1.12	....	1.07	1.22	1.12	1.19½	1.14⅜	1.20
May	1.16	1.20	1.12	....	1.11½	1.25½	1.19	1.26	1.19⅞	1.24½
June	1.18	1.19½	1.12	....	1.14¾	1.25¾	1.21	1.26	1.20½	1.24½
July	1.00	1.12	1.12	$1.15	1.14¾	1.27¼	1.21	1.23½	1.20⅛	1.25¾
August	1.00	1.20	1.15	1.25	1.17½	1.35½	1.23½	1.33	1.25¼	1.34¼
September	1.11	1.18	1.25	....	1.12¾	1.28⅝	1.23	1.28	1.21½	1.28⅝
October	1.12	1.19	1.25	....	1.12½	1.29¼	1.23	1.29	1.21½	1.28¼
November	1.19	1.35	1.25	....	1.18½	1.47	1.20	1.44¾	1.28⅛	1.46⅞
December	1.34	1.39½	1.25	....	1.33½	1.51½	1.42¼	1.47	1.41	1.49⅜

a No. 1 Northwestern.

Acreage, production, and value of flaxseed in the United States in 1908, by States.

State or Territory.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Dollars.*	*Dollars.*
Wisconsin	25,000	16.0	400,000	1.15	460,000
Minnesota	427,000	10.6	4,526,000	1.20	5,431,000
Iowa	33,000	10.9	360,000	1.10	396,000
Missouri	26,000	7.0	182,000	1.03	187,000
North Dakota	1,530,000	9.0	13,770,000	1.19	16,386,000
South Dakota	550,000	10.7	5,885,000	1.19	7,003,000
Nebraska	15,000	11.0	165,000	1.12	185,000
Kansas	58,000	6.5	377,000	1.02	385,000
Oklahoma	6,000	6.0	36,000	1.10	40,000
Montana	9,000	11.5	104,000	1.00	104,000
United States	2,679,000	9.6	25,805,000	1.184	30,577,000

RICE.

Rice crop of countries named, 1903–1907.

[Mostly cleaned rice. China, which is omitted, has a roughly-estimated crop of 50,000,000,000 to 60,000,000,000 pounds. Other omitted countries are Afghanistan, Algeria, Brazil, Colombia, Federated Malay States, Madagascar, Persia, Russia (Asiatic), Trinidad, and Tobago, Turkey (Asiatic and European), Venezuela, and a few other countries of small production.]

Country.	1903.	1904.	1905.	1906.	1907.
NORTH AMERICA.					
United States:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Contiguous	[a] 560,800,000	586,000,000	378,000,000	496,000,000	520,000,000
Noncontiguous—Hawaii [b]	33,400,000	33,400,000	33,400,000	33,400,000	33,400,000
Total United States (except Philippine Islands).	594,200,000	619,400,000	411,400,000	529,400,000	553,400,000
Central America:					
Guatemala	1,000,000	1,300,000	[c] 1,300,000	[c] 1,300,000	[c] 1,300,000
Honduras [d]	8,100,000	8,100,000	8,100,000	8,100,000	8,100,000
Mexico	48,700,000	62,000,000	55,151,000	[e] 55,151,000	[e] 55,151,000
Total North America	652,000,000	690,800,000	475,951,000	593,951,000	617,951,000
SOUTH AMERICA.					
Argentina	[f] 2,000,000	[f] 2,000,000	[f] 2,000,000	[f] 2,000,000	17,808,000
British Guiana	24,500,000	31,200,000	32,800,000	56,000,000	[g] 56,000,000
Dutch Guiana	1,000,000	1,900,000	2,500,000	3,298,000	3,311,000
Peru [f]	60,000,000	60,000,000	60,000,000	60,000,000	60,000,000
Total South America	87,500,000	95,100,000	97,300,000	121,298,000	137,119,000
EUROPE.					
Austria	200,000	200,000	300,000	200,000	....
Bulgaria	9,800,000	12,200,000	10,800,000	8,205,000	[g] 8,205,000
Italy	761,400,000	760,500,000	676,600,000	728,600,000	823,700,000
Spain	417,100,000	394,600,000	478,800,000	475,400,000	[g] 475,400,000
Total Europe	1,188,500,000	1,167,500,000	1,166,500,000	1,212,405,000	1,307,305,000

[a] Commercial movement.
[b] Census, 1899.
[c] Figures for 1904.
[d] Figures for 1901.
[e] Figures for 1905.
[f] Estimated average production.
[g] Figures for previous year.

Rice crop of countries named, 1903–1907—Continued.

Country.	1903.	1904.	1905.	1906.	1907.
ASIA.					
British India: [a]	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
British Provinces	68,580,000,000	71,561,000,000	67,916,000,000	67,464,000,000	60,729,000,000
Native States	[b] 838,000,000	[b] 764,000,000	[b] 640,000,000	[b] 687,000,000	[c] 687,000,000
Total British India	69,418,000,000	72,325,000,000	68,556,000,000	68,151,000,000	61,416,000,000
Ceylon	[b] 558,800,000	[b] 558,500,000	[b] 547,700,000	[b] 498,100,000	[c] 498,100,000
French Indo-China [d]	5,000,000,000	5,000,000,000	5,000,000,000	5,000,000,000	5,000,000,000
Japanese Empire:					
Japan	14,512,600,000	16,060,600,000	11,920,000,000	14,459,285,000	15,315,325,000
Formosa	2,296,600,000	2,598,100,000	2,719,200,000	[e] 2,719,200,000	[e] 2,719,200,000
Total Japanese Empire	16,809,200,000	18,658,700,000	14,639,200,000	17,178,485,000	18,034,525,000
Java and Madura	6,229,000,000	6,431,000,000	6,268,000,000	6,630,000,000	[c] 6,630,000,000
Korea [f]	3,300,000,000	3,200,000,000	3,200,000,000	3,200,000,000	3,200,000,000
Philippine Islands	[g] 677,800,000	[e] 544,000,000	544,000,000	725,000,000	695,000,000
Siam [h]	6,824,000,000	6,824,000,000	6,824,000,000	6,824,000,000	6,824,000,000
Straits Settlements	[b] 95,000,000	[b] 95,000,000	[b] 93,000,000	[b] 94,000,000	[c] 94,000,000
Total Asia	108,911,800,000	113,636,200,000	105,671,900,000	108,300,585,000	102,391,625,000
AFRICA.					
British Central Africa	[i] 2,200,000	2,200,000	1,800,000	1,400,000	[c] 1,400,000
Egypt [d]	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
Total Africa	22,200,000	22,200,000	21,800,000	21,400,000	21,400,000
OCEANIA.					
Fiji [b]	3,000,000	3,000,000	2,800,000	2,800,000	3,800,000
Grand total	110,865,000,000	115,614,800,000	107,436,251,000	110,252,439,000	104,479,200,000

[a] Figures for British India refer to crop years beginning in the spring of the calendar years mentioned in this table.
[b] Estimated from official returns of acreage.
[c] Figures for previous year.
[d] Estimated average production.
[e] Figures for 1905.
[f] Estimated from official returns of exports of this country, and from per capita consumption of rice in Japan, including food, seed, and waste, but not including rice used for saké, for 1904 (270 pounds per annum).
[g] Census 1902.
[h] Official estimate 1903.
[i] Figures for 1904.

Acreage, production, value, etc., of rice in the United States, 1904–1908.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.	Condition of growing crop			
						July 1.	Aug. 1.	Sept. 1.	When harvested.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1904	662,006	31.9	21,096,038	65.8	13,891,523	88.2	90.2	89.7	87.3
1905	460,198	28.1	12,933,436	95.0	12,285,834	88.0	92.9	92.2	89.3
1906	575,014	31.1	17,854,768	90.3	16,121,298	82.9	83.1	86.8	87.2
1907	627,300	29.9	18,738,000	85.8	16,081,000	88.7	88.6	87.0	88.7
1908	655,000	33.4	21,889,620	81.2	17,771,281	92.9	94.1	93.5	87.7

Wholesale prices of rice per pound, 1896–1908.

Date.	New York.		Cincinnati.		Lake Charles.		New Orleans.		Houston.	
	Domestic (good).		Prime.[a]		Rough.[b]		Honduras, cleaned.		Head rice, cleaned.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Dolls.*	*Dolls.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1896	3½	4¾	2¼	6½	......	......	......	......	......	......
1897	4⅜	4⅞	3½	6¾	......	......	4¼	4⅝	......	......
1898	4⅞	5⅝	5½	7	......	......	4¼	5½	......	......
1899	4¾	5½	5¼	6¾	......	......	3¾	6⅜	......	......
1900	4¾	5	5½	6	......	......	3¾	6⅝	......	......
1901	4¼	5	5½	6½	1.70	3.50	1¾	6⅝	3	5
1902	4¾	5½	5¼	6½	1.75	3.40	1½	6½	3½	5¾
1903	4¼	5¼	4⅞	5½	1.50	3.60	1⅛	6½	4	6¼
1904	3⅜	4¼	3¾	5¼	1.00	3.00	1 1/16	5¼	3	4¾
1905.										
January	3⅜	3⅝	3¾	4¼	1.00	2.00	1⅛	5⅛	3	3¾
February	3⅜	3⅝	3¾	4¼	1.00	2.00	1	4¾	3	3¾
March	3⅞	3⅝	3	4	1.00	2.35	1 3/16	4⅝	3	3¼
April	3⅜	3⅜	3	4	1.00	2.25	1⅛	4⅛	3	3½
May	3⅜	3⅜	3½	4½	1.00	2.50	1⅜	4½	3	3½
June	3½	3¾	4	5	1.00	2.50	2⅛	5	3	3¼
July	3¾	3¾	4	5	1.00	2.50	2⅛	4¾	3	4
August	3¾	3¾	4	5	1.25	3.00	1¾	5¼	3	4¼
September	3¼	4	4	5	2.00	2.25	1¾	5⅝	3	4½
October	4⅛	4⅛	4	5	2.00	3.25	2	5¼	3	4¾
November	4⅛	4⅛	4½	5¼	2.00	3.75	2⅜	5⅜	3	5
December	4½	4½	4½	5¼	2.00	3.85	2	5⅛	3½	5
1906.										
January	5	5¼	4½	5¼	2.25	3.85	2⅝	5⅜	4	5½
February	5	5¼	4½	5¼	2.25	3.85	2⅜	5½	4	5½
March	5	5	4½	5¼	2.25	3.85	2	5½	4	5½
April	4⅞	5	4½	5½	......	......	2½	5¾	3½	5
May	4⅞	5	4¾	5¼	......	......	1⅞	6	3½	5
June	5	5¼	4¾	5½	......	......	2⅛	5¾	3¾	5¼
July	5¼	5½	4¾	5½	......	......	2⅛	5¾	3¾	5¼
August	5¼	5¼	4¾	5½	2.50	3.85	2	6½	3¾	5¼
September	5¼	5¼	4¾	5½	2.50	3.85	2⅜	5¾	3¾	5¼
October	5⅜	5½	4¾	5½	2.25	3.85	2⅛	5¾	4¼	5¼
November	5¼	5⅜	4¾	5½	2.25	3.50	2	5⅝	4½	5¼
December	5	5¼	4¾	5½	2.00	3.25	1¾	5¼	4	5¼
1907.										
January	5	5¼	4¾	5½	2.00	3.50	1¾	6	5	5⅛
February	5	5¼	4¾	5½	2.00	3.50	1¾	6	5⅛	5¼
March	5	5¼	4¾	5½	2.25	3.50	1½	5½	5½	5¼
April	5⅛	5¼	4¾	5½	1.75	3.00	1½	5¾	5½	5¼
May	5¼	5½	4¾	5¾	......	......	1⅝	6	5⅜	5¾
June	5½	5¾	5	6	......	......	2½	6½	6	6
July	5¾	6	5	6	......	......	2⅛	6½	6½	6¼
August	5⅞	6	5	6	......	......	2	6½	6⅛	6¼
September	5¾	6	5	6	2.35	3.60	2¼	6 1/16	5⅝	5¾
October	5½	5¾	4¾	6	2.35	4.10	2	6¼	5⅜	5½
November	5¼	5½	4¾	5¾	2.60	3.90	2	5⅞	4⅞	5⅝
December	5	5¼	4¾	5¾	2.00	3.90	1⅞	6	4⅜	5⅛
1908.										
January	5	5¼	6¾	7½	2.25	3.75	2	6	4¾	5¼
February	5¼	5⅝	6¾	7¼	2.00	4.25	2	6 3/16	5	5½
March	5⅝	5¾	6¾	7¼	2.25	4.33	2⅛	6¼	5	5½
April	5¾	5¾	6¾	7¼	......	......	2½	6¼	5⅛	5¾
May	5¾	5⅞	6¾	7¼	......	......	2⅝	6⅛	5½	6
June	5⅞	6¼	6¾	7¼	......	......	2⅛	6¼	5¼	6⅛
July	6¼	6¼	6¾	7¼	......	......	3	7⅛	5½	6¼
August	6¼	6½	6¾	7¼	2.50	3.50	2½	7	5½	6
September	5¾	6	6¼	7¼	2.00	3.60	1⅞	6	5¼	5¾
October	5¼	5½	6¼	6¾	1.75	3.75	1¾	6	5	5¾
November	5	5½	6¼	6¾	2.25	3.60	1⅞	5¾	4¾	5¼
December	5	5¼	6¼	6¾	1.75	3.40	1¾	5¾	4¾	5¼

[a] Louisiana grade, 1896 to 1901.

[b] Per barrel of 162 pounds.

Acreage, production, and value of rice in the United States in 1908, by States.

State.	Acreage	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
North Carolina	600	25.2	15,120	100	15,120
South Carolina	20,000	24.0	480,000	106	508,800
Georgia	3,500	25.0	87,500	109	95,375
Florida	2,000	25.0	50,000	92	46,000
Alabama	1,400	45.0	63,000	80	50,400
Mississippi	1,100	31.0	34,100	83	28,303
Louisiana	350,000	33.0	11,550,000	78	9,009,000
Texas	265,000	34.5	9,142,500	83	7,588,275
Arkansas	11,400	41.0	467,400	92	430,008
United States	655,000	33.4	21,889,620	81.2	17,771,281

International trade in rice, 1903–1907. [a]

[Mostly cleaned rice.]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Belgium	Jan. 1	49,161,919	60,794,820	41,923,262	73,215,968	61,676,146
British India	Jan. 1	5,133,712,688	5,561,708,208	5,110,049,504	4,284,929,600	4,296,099,024
Dutch East Indies	Jan. 1	85,391,653	105,792,310	98,247,103	100,703,857	111,730,242
Formosa	Jan. 1	184,676,337	197,154,447	221,561,825	161,759,068	118,613,188
France	Jan. 1	58,795,657	52,017,359	54,089,610	69,981,537	[b] 98,088,924
French Indo-China	Jan. 1	1,490,364,515	2,128,799,044	1,369,646,421	1,623,918,163	3,033,562,560
Germany [c]	Jan. 1	227,661,173	181,073,762	222,773,526	300,225,203	338,463,711
Netherlands	Jan. 1	256,578,864	298,075,104	282,611,808	295,873,665	315,264,586
Penang	Jan. 1	229,739,333	154,148,400	213,530,667	279,941,999	[d] 279,941,999
Siam	Jan. 1	1,310,950,400	1,892,988,933	1,835,880,400	1,921,339,467	1,777,680,000
Singapore	Jan. 1	687,836,400	702,571,733	672,031,467	689,046,531	[d] 689,046,531
Other countries	....	580,626,000	517,791,000	678,783,223	682,841,706	[b] 803,227,405
Total	....	10,295,494,939	11,852,915,120	10,801,128,816	10,483,776,764	11,923,394,316

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Austria-Hungary	Jan. 1	162,532,230	189,403,926	156,519,564	224,874,090	[b] 192,457,769
Belgium	Jan. 1	129,772,365	140,564,807	132,971,397	149,701,442	135,585,126
Brazil	Jan. 1	162,235,816	134,043,452	129,413,871	88,821,786	25,531,727
British India	Jan. 1	192,781,456	195,294,176	344,832,880	315,943,712	237,331,920
Ceylon	Jan. 1	687,640,128	699,259,008	714,172,144	731,312,784	749,729,755
China	Jan. 1	373,585,867	447,577,333	297,055,467	624,860,267	1,702,025,200
Cuba	Jan. 1	149,574,339	196,439,462	214,934,597	192,766,374	258,424,544
Dutch East Indies	Jan. 1	440,099,790	678,382,754	661,108,710	762,003,092	[d] 762,003,092
Egypt	Jan. 1	84,159,745	104,163,198	89,979,896	101,814,530	95,461,175
France	Jan. 1	210,890,911	412,469,802	375,080,970	387,572,768	[b] 345,948,402
Germany [c]	Jan. 1	642,295,455	602,833,603	627,278,011	671,849,295	750,601,700
Japan	Jan. 1	1,621,654,000	1,964,238,000	1,546,121,733	813,478,133	902,701,867
Mauritius	Jan. 1	141,143,562	159,853,482	114,012,106	134,012,761	131,022,304
Netherlands	Jan. 1	495,788,960	523,497,732	493,955,916	561,916,461	566,643,424
Penang	Jan. 1	153,461,067	252,778,533	263,046,133	276,500,933	[d] 276,500,933
Philippine Islands	Jan. 1	737,083,174	585,880,567	483,411,974	280,101,412	262,399,906
Russia	Jan. 1	162,267,811	157,232,062	177,144,824	210,598,294	[b] 65,255,830
Singapore	Jan. 1	849,067,467	900,587,600	816,150,667	810,458,665	[d] 810,458,665
United Kingdom	Jan. 1	607,701,584	620,591,664	685,939,744	768,403,216	684,817,616
United States	Jan. 1	177,804,747	136,587,147	109,544,299	209,152,583	203,560,814
Other countries	....	1,070,847,000	1,199,722,000	1,195,514,115	1,284,847,364	[b] 1,255,957,231
Total	....	9,252,387,474	10,301,400,308	9,628,189,018	9,600,989,962	10,414,419,000

[a] See "General note," p. 605.
[b] Preliminary.
[c] Not including free ports prior to March 1, 1906.
[d] Year preceding.

HOPS.

Hop crop of countries named, 1904–1908.

[Excluding Canada, for which the census of 1901 shows a production during the preceding year of 1,004,216 pounds. Other omitted countries are of very small production.]

Country	1904.	1905	1906.	1907.	1908.
NORTH AMERICA					
United States: [a]	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
New York	11,880,000	9,360,000	12,006,000	9,000,000	8,000,000
California	12,285,000	14,235,000	15,520,000	15,000,000	12,000,000
Oregon	17,550,000	22,191,000	23,985,000	23,000,000	16,000,000
Washington	7,410,000	9,750,000	8,775,000	7,000,000	3,000,000
Total United States	49,125,000	55,536,000	60,286,000	54,000,000	39,000,000
EUROPE.					
Austria-Hungary:					
Austria	19,598,000	39,305,000	15,012,000	29,975,000	31,747,000
Hungary	592,000	775,000	1,647,000	2,254,000	2,205,000
Total Austria-Hungary	20,190,000	40,080,000	16,659,000	32,229,000	33,952,000
Belgium	9,830,000	11,281,000	7,705,000	6,790,000	[b] 8,818,000
France	7,753,000	11,065,000	9,156,000	8,672,000	[b] 7,165,000
Germany	49,136,000	64,500,000	46,384,000	53,255,000	58,069,000
Netherlands [c]	158,000	158,000	158,000	158,000	158,000
Russia	8,700,000	14,500,000	8,775,000	12,639,000	[b] 6,063,000
United Kingdom: England	31,621,000	77,946,000	27,517,000	41,902,000	52,725,000
Total Europe	127,388,000	219,530,000	116,354,000	155,645,000	166,950,000
AUSTRALASIA.					
Australia:					
Victoria	274,000	162,000	213,000	312,000	[d] 312,000
Tasmania	865,000	912,000	989,000	1,356,000	[d] 1,356,000
New Zealand	1,150,000	1,120,000	[e] 1,035,000	[e] 1,035,000	[e] 1,035,000
Total Australasia	2,289,000	2,194,000	2,237,000	2,703,000	2,703,000
Grand total	178,802,000	277,260,000	178,877,000	212,348,000	208,653,000

[a] Estimate based upon reports to California Fruit Grower and American Agriculturist.
[b] Estimated.
[c] Average, 1900–1903.
[d] Year preceding.
[e] Average, 1902–1905.

International trade in hops, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	5,900,230	10,037,424	18,777,206	12,365,284	[b] 17,815,109
Belgium	Jan. 1	3,438,251	9,665,294	2,582,318	3,178,692	2,166,826
France	Jan. 1	442,521	784,610	606,364	382,722	[b] 386,911
Germany [c]	Jan. 1	22,003,671	24,358,207	22,855,096	26,767,198	22,540,055
Netherlands	Jan. 1	1,235,779	2,104,063	1,256,989	1,534,058	1,561,238
New Zealand	Jan. 1	433,776	644,336	369,712	493,360	286,160
Russia	Jan. 1	1,744,212	1,117,294	1,140,117	1,978,368	[b] 650,030
United Kingdom	Jan. 1	2,499,504	1,554,336	1,820,448	1,300,096	1,168,720
United States	Jan. 1	9,199,448	17,777,608	5,713,682	17,701,436	16,090,959
Other countries		105,996	138,335	63,125	140,828	[b] 260,969
Total		47,003,388	68,181,507	55,185,057	65,842,042	62,926,977

[a] See "General note," p. 605. [b] Preliminary. [c] Not including free ports prior to Mar. 1, 1906.

International trade in hops, 1903–1907—Continued.

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Australia	Jan. 1	975,658	913,830	1,279,362	1,412,569	1,412,569
Austria-Hungary	Jan. 1	4,481,556	2,109,162	1,187,189	1,346,363	[a] 773,602
Belgium	Jan. 1	6,478,233	4,826,301	6,617,221	5,431,355	5,577,912
British India	Jan. 1	490,112	488,432	485,184	307,216	470,736
Canada	Jan. 1	736,558	842,973	964,962	699,630	1,223,473
Cape of Good Hope [b]	Jan. 1	555,856	487,424	308,112	657,858	588,672
Denmark	Jan. 1	1,401,037	1,359,149	1,378,660	1,297,861	1,293,011
France	Jan. 1	5,045,432	4,428,343	3,879,328	4,386,095	[c] 4,298,572
Germany [c]	Jan. 1	2,902,995	5,346,208	9,047,989	4,865,380	6,666,336
Netherlands	Jan. 1	2,742,861	4,020,148	3,368,742	3,497,750	3,372,957
Russia	Jan. 1	807,085	1,363,547	1,199,162	1,452,240	[a] 1,300,061
Sweden	Jan. 1	1,436,809	1,298,174	1,662,563	1,275,477	1,488,832
Switzerland	Jan. 1	1,012,142	1,168,891	1,347,685	1,087,540	1,421,540
United Kingdom	Jan. 1	11,876,032	34,437,312	11,147,584	25,702,992	21,902,048
United States	Jan. 1	3,885,974	4,736,488	5,968,533	7,849,548	7,163,356
Other countries		3,200,012	2,454,058	2,514,950	4,107,343	[a] 3,520,289
Total		48,118,352	70,280,440	52,357,226	65,377,247	62,473,971

[a] Preliminary.
[b] After 1905 the figures relate to British South Africa.
[c] Not including free ports prior to Mar. 1, 1906.

Wholesale prices of hops per pound, 1895–1908.

Date.	New York.		Cincinnati.		Chicago.	
	Choice State.		Choice.		Pacific coast, good to choice. [a]	
	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1895	6½	11	6	11	5	11
1896	7	15	6	15	4	14
1897	7	18	8	18	6	17
1898	11	20	14	20	5	19½
1899	12	18	13	19	7	18
1900	12½	21	10	18	6½	18
1901	13	20	13¾	17$\frac{9}{10}$	12½	19
1902	14	38	14½	30	12½	31
1903	20½	37	24	29½	19	31
1904	32	41	28	37	28½	37
1905.						
January	34	37	33	33	30	34
February	30	36	31½	31½	26	30
March	27	31	30	30	26	30
April	27	29	29	29	26	29
May	27	29	29	29	26	28
June	26	29	28	28	21	25
July	25	27	24	24	20	24
August	22	26	22	22	18	23
September	20	23	18½	18½	15	18
October	19	23	17	17	10	15
November	13	22	14½	14½	12	15
December	16	21	13½	13½	10	14
1906.						
January	15	19	13	14½	12	14
February	14	17	13	14½	10	14
March	13	16	12	14	9	14
April	12	15	12	17	10	17
May	11	15	12	15	9	15
June	11	14	12	15	9	14
July	12	17	12	17½	10	17
August	15	17	17	18	12	18
September	15	17	14	18	12	22
October	22	25	17	18	14	18
November	23	25	17½	18½	13	18
December	21	24	17½	18½	12	18
			(b)		(c)	
1907.						
January	21	23	16½	......	12	18
February	21	23	16½	......	12	17
March	21	23	14½	......	10	15
April	15	20	13	......	8	12
May	15	16	13	......	10	13
June	15	16	14	......	8	12
July	15	16	13½	......	7	11
August	14	16	12½	......	6	9
September	12	15	12	......	10	13
October	12	18	12	......	9	13
November	16	18	12	......	8	12
December	16	17	12	......	8	11
					(d)	
1908.						
January	15	16	10	......	8	11
February	13	16	9½	......	6	10
March	11	14	9	......	6	9
April	11	12	8½	......	6	8
May	11	12	8½	......	6	10
June	9	12	8½	......	6	10
July	7	11	8½	......	5	9
August	6	8	8	......	5	8
September	6	7	8	......	9	11
October	13	14	12	......	9	11
November	13	14	11	......	9	11
December	12	14	11	......	9	11

[a] Common to choice, 1895 to 1903.
[b] Prime.
[c] Prime to choice.
[d] Pacific coast, good to choice.

SUGAR.

Sugar production of countries named, 1904–5 to 1908–9.

[European beet sugar, as estimated by Licht; United States beet sugar, from reports of Department of Agriculture on the Progress of the Beet-Sugar Industry in the United States; production of British India throughout, and of Formosa and Natal prior to 1905–6, from official statistics; other data, from Willett & Gray. The estimates of Willett & Gray do not include the production of China and some other less important sugar-producing countries.]

Country.	1904–5.	1905–6.	1906–7.	1907–8.	1908–9.
CANE SUGAR.					
NORTH AMERICA.					
United States:					
Contiguous—	*Tons.* [a]	*Tons.* [a]	*Tons.* [a]	*Tons.* [a]	*Tons.* [a]
Louisiana	355,531	330,000	230,000	335,000	350,000
Texas	15,000	12,000	13,000	12,000	15,000
Noncontiguous—					
Hawaii	380,576	383,225	392,871	465,288	465,000
Porto Rico	145,000	213,000	210,000	200,000	215,000
Total United States (except Philippine Islands)	896,107	938,225	845,871	1,012,288	1,045,000
Central America:					
Costa Rica	2,305	1,377	2,365	2,415	2,500
Guatemala	7,640	6,795	7,469	7,178	7,500
Nicaragua	4,235	4,400	3,905	4,175	4,500
Salvador	5,588	5,944	6,008	5,490	6,500
Mexico	107,038	107,529	119,496	123,285	125,000
West Indies:					
British—					
Antigua and St. Kitts	24,000	24,000	28,319	20,000	24,000
Barbados [b]	41,600	49,864	32,950	29,340	30,000
Jamaica [b]	11,251	12,523	13,971	10,718	4,500
Trinidad [b]	31,000	56,455	45,631	41,626	45,000
Cuba	1,163,258	1,178,749	1,427,673	961,958	1,350,000
Danish—St. Croix	11,000	13,000	13,000	13,000	14,000
French—					
Guadeloupe	36,000	36,000	38,960	37,500	39,000
Martinique [b]	29,986	42,231	36,764	35,943	35,000
Haiti and Santo Domingo	47,000	55,090	60,000	50,000	60,000
Lesser Antilles	13,000	13,000	5,662	5,000	6,000
Total North America	2,431,008	2,545,182	2,688,044	2,359,916	2,798,500
SOUTH AMERICA.					
Argentina	128,104	137,308	116,287	109,445	150,000
Brazil	195,000	275,000	215,000	180,000	280,000
British Guiana [b]	101,278	121,693	120,334	99,737	125,000
Dutch Guiana	13,000	13,000	13,000	13,000	14,000
Peru	150,000	150,000	161,156	135,336	150,000
Venezuela	3,000	3,000	3,000	3,000	3,000
Total South America	590,382	700,001	628,777	540,518	722,000
EUROPE.					
Spain	18,592	15,722	16,400	11,000	22,000
ASIA.					
British India [c]	2,169,000	1,725,500	2,205,300	2,054,700	1,841,800
Formosa	48,897	64,190	81,448	68,450	80,000
Java	1,008,900	990,994	1,011,546	1,156,477	1,190,000
Philippine Islands	106,875	145,525	145,500	150,000	150,000
Total Asia	3,333,672	2,926,209	3,443,794	3,429,627	3,261,800

[a] Tons of 2,240 pounds, except beet sugar in Europe, which is shown in metric tons of 2,204.622 pounds.
[b] Exports.
[c] Official estimates for such parts of British India as return statistics of production.

Sugar production of countries named, 1904–5 to 1908–9—Continued.

Country.	1904–5.	1905–6.	1906–7.	1907–8.	1908–9.
CANE SUGAR—Continued.					
AFRICA.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Egypt	60,000	65,000	42,195	40,000	45,000
Mauritius	142,101	188,364	220,000	170,000	190,000
Natal	19,239	26,603	27,130	35,000	35,000
Reunion	30,000	38,000	37,500	35,000	37,000
Total Africa	251,340	317,967	326,825	280,000	307,000
OCEANIA.					
Australia:					
Queensland	147,688	170,000	182,000	188,307	151,554
New South Wales	21,525	20,000	24,000	23,418	15,000
Fiji [a]	47,000	40,000	43,000	69,000	65,000
Total Oceania	216,213	230,000	249,000	280,725	231,554
Total cane-sugar production	6,841,207	6,735,081	7,352,840	6,901,786	7,342,854
BEET SUGAR					
NORTH AMERICA.					
United States	216,173	279,393	431,796	413,954	380,254
Canada	8,034	11,419	11,367	7,943	6,964
Total North America	224,207	290,812	443,163	421,897	387,218
EUROPE.					
Austria-Hungary	889,373	1,509,789	1,343,940	1,424,657	1,400,000
Belgium	176,466	328,770	282,804	232,352	255,000
France	622,422	1,089,684	756,094	727,712	800,000
Germany	1,598,164	2,418,156	2,239,179	2,129,597	2,060,000
Netherlands	136,551	207,189	181,417	175,184	212,000
Russia	953,626	968,500	1,440,130	1,410,000	1,275,000
Other countries	332,098	410,255	467,244	462,772	500,000
Total Europe	4,708,700	6,932,343	6,710,808	6,562,274	6,502,000
Total beet-sugar production	4,932,907	7,223,155	7,153,971	6,984,171	6,889,218
Total cane and beet sugar	11,774,114	13,958,236	14,506,811	13,885,957	14,232,072

[a] Exports.

Sugar-beet acreage and beet-sugar production in the United States, 1901 to 1908.

[From reports of Department of Agriculture on Progress of the Beet-Sugar Industry in the United States.]

State and year.	Factories in operation.	Area harvested.	Average yield of beets per acre.	Beets worked.	Sugar manufactured.	Average extraction of sugar based on weight of beets.	Average sugar in beets.	Average purity coefficient of beets.[a]	Average length of campaign.
1908.		*Acres.*	*Tons.*[b]	*Tons.*[b]	*Pounds.*	*Per cent.*	*P. cent.*	*P. cent.*	*Days.*
California	8	62,302	10.38	647,085	179,780,000	13.89	17.66	83.2	88
Colorado	15	119,475	9.28	1,108,961	244,560,000	11.03	13.85	81.8	78
Idaho	4	20,989	9.80	205,657	52,300,000	12.72	15.84	86.9	78
Michigan	16	81,073	7.54	611,295	170,598,000	13.95	17.11	84.8	61
Utah	5	31,152	12.81	399,218	93,390,000	11.70	14.10	84.1	127
Wisconsin	4	14,700	9.37	137,800	36,640,000	13.30	16.72	84.5	71
States having but a single factory each:[c]									
Illinois Iowa Kansas Minnesota Montana Nebraska New York Ohio Oregon Washington	10	35,222	8.65	304,875	74,500,000	12.22	15.22	82.0	54
Totals and averages[d]	62	364,913	9.36	3,414,891	851,768,000	12.47	15.74	83.5	74
1907	63	370,984	10.16	3,767,871	927,256,430	12.30	15.8	83.6	89
1906	63	376,074	11.26	4,236,112	967,224,000	11.42	14.9	82.2	105
1905	52	307,364	8.67	2,665,913	625,841,228	11.74	15.3	83.0	77
1904	48	197,784	10.47	2,071,539	484,226,430	11.69	15.3	83.1	78
1903	49	242,576	8.56	2,076,494	481,209,087	11.59	[e]15.1	([f])	75
1902	41	[g]216,400	8.76	1,895,812	436,811,685	11.52	[e]14.6	[e]83.3	94
1901	36	175,083	9.63	1,685,689	369,211,733	10.95	14.8	82.2	88

[a] By purity coefficient is meant the percentage of sugar in the total solids of the substance tested, whether it be beets, juice, or sugar. In this table it represents the average percentage of sugar in the total solids of the beets as determined by tests made at the factories.

[b] Tons of 2,000 pounds each.

[c] Grouped together to avoid giving publicity to data relating to individual factories.

[d] The average yield of beets per acre is found by dividing the total beets worked by the total acreage harvested; the average extraction of sugar by dividing the total sugar produced by the total beets worked; the average contents of sugar, coefficients of purity, and length of campaign by adding the figures reported by the different factories and dividing by the number of reporting factories.

[e] These averages are not based on data for all the factories, as some of them failed to report results of tests, but it is believed that they fairly represent the character of the total beet crops.

[f] No data reported.

[g] Based on reports from 27 factories and careful estimates for 14 others.

Production of sugar in the United States and its possessions, 1839–40 to 1908–9.

[Census data, as far as available, are given in *italics*. Census of 1840 did not separate cane and maple sugar; statistics here given for "Other Southern States" represent production of all sugar in South Carolina, Georgia, Florida, Tennessee, Alabama, and Mississippi. Censuses of 1850 and 1860 give returns in "Hogsheads of 1,000 pounds" and Censuses of 1870 and 1880 in "Hogsheads;" these returns were converted into pounds in Census Abstract of 1890 at rate of 1,200 pounds to the hogshead and in Census of 1900 at rate of 1,000 pounds. Beet-sugar production for 1897–98 from Special Report of Department of Agriculture; for 1901–2 and later years from Progress of the Beet-Sugar Industry in the United States; for other years from Willett & Gray. Production of cane sugar in Louisiana beginning with 1905–6, and in Texas beginning with 1903–4, from Willett & Gray; earlier statistics for Louisiana and other Southern States from Bouchereau, in part taken directly from his reports and in part from the Statistical Abstract. Porto Rican production of cane sugar for 1854–55 to 1884–85 from Rueb & Co.; for later years from Willett & Gray. Statistics for Hawaii, 1874–75 to 1880–81, represent exports, from Bureau of Statistics Bul. 30; for 1881–82 to 1884–85 from Rueb & Co.; for later years from Willett & Gray. Statistics for Philippine Islands for 1854–55 to 1857–58, 1859–60 to 1866–67, 1872–73 to 1894–95 represent exports as officially returned, taken from the Census of the Philippine Islands, 1903; for 1858–59, 1867–68 to 1871–72 from Foreign Markets Bul. 14, representing commercial estimates of exports; subsequently from Willett & Gray, the statistics for 1895–96 to 1903–4 representing exports, later years, production. Tons of 2,240 pounds are used throughout.]

Year.	Beet sugar.	Cane sugar.					Total.
		Louisiana.	Other Southern States.	Porto Rico.	Hawaii.	Philippine Islands.	
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1839–40 (Census)	....	*53,548*	*408*	....	....	....	....
		Hogsheads.	*Hogsheads.*				
1849–50 (Census)	....	*226,001*	*21,576*	....	....	....	....
		Long tons.	*Long tons.*				
1854–55	....	171,976	13,169	58,377	....	35,008	278,530
1855–56	....	113,647	9,821	82,000	....	47,397	252,865
1856–57	....	36,327	2,673	85,000	....	36,066	160,066
1857–58	....	137,351	6,385	69,444	....	26,858	240,038
1858–59	....	185,177	8,169	58,000	....	50,095	301,441
1859–60	....	113,891	5,149	57,000	....	49,013	225,053
		Hogsheads.	*Hogsheads.*				
1859–60 (Census)	....	*221,726*	*9,256*	....	....	....	....
		Long tons.	*Long tons.*				
1860–61	....	118,332	4,313	67,000	....	45,316	234,961
1861–62	....	235,858	5,138	68,000	....	60,957	369,953
1862–63	....	43,232	2,768	63,000	....	51,240	160,240
1863–64		37,723	250	61,590	....	44,325	144,288
1864–65		4,821	179	63,375	....	46,092	114,867
1865–66		8,884	348	64,417	....	40,636	114,685
1866–67		19,152	3,348	68,229	....	55,195	146,324
1867–68		18,482	4,518	73,935	....	74,081	171,416
1868–69	a 400	42,434	2,567	81,500	....	68,818	195,719
1869–70		44,399	2,402	102,110	....	78,214	227,525
		Hogsheads.	*Hogsheads.*				
1869–70 (Census)		*80,706*	*6,337*	....	....	....	....
		Long tons.	*Long tons.*				
1870–71		75,392	4,208	103,304	....	87,465	270,769
1871–72		65,583	4,217	89,559	....	95,526	255,285
1872–73	500	55,958	4,235	87,639	....	83,865	232,197
1873–74	700	46,090	2,410	71,755	....	99,770	220,725
1874–75		60,047	3,454	72,128	11,197	126,089	273,015
1875–76	b 100	72,954	4,046	70,016	11,639	128,485	287,240
1876–77		85,122	3,879	62,340	11,418	121,052	283,911
1877–78		65,671	5,330	84,347	17,157	120,096	292,701
1878–79	200	106,910	5,090	76,411	21,884	129,777	340,272
1879–80	1,200	88,822	3,980	57,057	28,386	178,329	357,774
		Hogsheads.	*Hogsheads.*				
1879–80 (Census)	....	*171,706*	*7,166*	....	....	....	....
		Long tons.	*Long tons.*				
1880–81	500	121,867	5,500	61,715	41,870	205,508	436,960
1881–82	b 500	71,373	5,000	80,066	50,972	148,047	355,958
1882–83		135,297	7,000	77,632	51,705	193,726	465,860
1883–84	535	128,443	6,800	98,665	63,948	120,199	418,590
1884–85	953	94,376	6,500	70,000	76,496	200,997	449,322
1885–86	600	127,958	7,200	64,000	96,500	182,019	478,277
1886–87	800	80,859	4,535	86,000	95,000	169,040	436,234
1887–88	255	157,971	9,843	60,000	100,000	158,445	486,514
1888–89	1,861	144,878	9,031	62,000	120,000	224,861	562,631
1889–90	2,203	128,344	8,159	55,000	120,000	142,554	456,260
1889–90 (Census)	....	*130,413*	*4,089*	....	....	....	....

a Mean annual production; quantity varied from year to year between 300 and 500 tons.
b Production uncertain; not exceeding quantity stated.

Production of sugar in the United States and its possessions, 1839–40 to 1908–9—Con.

Year	Beet sugar.	Cane sugar.					Total.
		Louisiana.	Other Southern States.	Porto Rico.	Hawaii.	Philippine Islands.	
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1890–91	3,459	215,844	6,107	50,000	125,000	136,035	536,445
1891–92	5,356	160,937	4,500	70,000	115,598	248,806	605,197
1892–93	12,018	217,525	5,000	50,000	140,000	257,392	681,935
1893–94	19,950	265,836	6,854	60,000	136,689	207,319	696,648
1894–95	20,092	317,334	8,288	52,500	131,698	336,076	865,988
1895–96	29,220	237,721	4,973	50,000	201,632	230,000	753,546
1896–97	37,536	282,009	5,570	58,000	224,218	202,000	809,333
1897–98	40,398	310,447	5,737	54,000	204,833	178,000	793,415
1898–99	32,471	245,512	3,442	53,826	252,507	93,000	680,758
1898–99 (Census)	....	*248,658*	*a 5,266*	....	....	....	....
1899–1900	72,944	147,164	2,027	35,000	258,521	62,785	578,441
1899–1900 (Census)	*72,972*	*142,485*	*1,510*	....	*242,008*	....	....
1900–1901	76,859	275,579	2,891	80,000	321,461	55,400	812,190
1901–2	164,827	321,676	3,614	85,000	317,509	78,637	971,203
1902–3	195,005	329,227	3,722	85,000	391,062	90,000	1,094,016
1902 (Census)	....	....	....	....	....	*177,371*	....
1903–4	214,825	228,477	a 19,800	130,000	328,103	84,000	1,005,205
1904–5	216,173	355,531	a 15,000	145,000	380,576	106,875	1,219,155
1904–5 (Census)	*226,715*	....	....	....	....	....	....
1905–6	279,393	330,000	a 12,000	213,000	383,225	145,525	1,363,143
1906–7	431,796	230,000	a 13,000	210,000	392,871	145,500	1,423,167
1907–8	413,954	335,000	a 12,000	200,000	465,288	150,000	1,576,242
1908–9	380,254	350,000	a 15,000	215,000	465,000	150,000	1,575,254

a Texas.

International trade in sugar, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	1,564,437,691	1,125,102,823	1,265,791,878	1,631,945,421	b 1,605,043,080
Argentina	Jan. 1	66,888,231	40,368,833	4,847,964	233,690	140,653
Belgium	Jan. 1	257,180,695	406,944,665	304,193,682	462,976,753	381,087,983
Brazil	Jan. 1	48,256,967	17,331,526	83,216,786	7,278,992	28,346,293
British Guiana	Apr. 1	282,125,760	239,043,840	261,072,000	257,490,240	225,650,880
British India	Jan. 1	52,935,904	50,817,088	60,302,704	46,609,920	46,583,376
China	Jan. 1	39,890,000	48,787,467	69,228,800	59,815,600	47,729,733
Cuba	Jan. 1	2,118,279,646	2,459,166,945	2,412,915,391	2,643,700,975	b 2,881,760,000
Dutch East Indies	Jan. 1	1,907,867,945	2,318,243,282	2,314,655,085	2,197,208,868	c 2,197,208,868
Egypt	Jan. 1	86,469,803	50,620,531	67,821,106	10,495,854	9,206,628
Formosa	Jan. 1	54,128,545	79,518,816	93,930,689	147,283,970	124,809,731
France	Jan. 1	469,129,814	636,360,461	658,062,149	617,793,487	b 704,731,673
Germany d	Jan. 1	2,249,141,034	1,720,574,091	1,636,803,746	2,671,855,698	2,009,737,163
Mauritius	Jan. 1	375,505,049	435,923,559	361,987,596	410,919,376	431,547,424
Netherlands	Jan. 1	287,238,939	403,476,558	215,001,603	360,050,106	299,971,063
Peru	Jan. 1	281,482,880	290,916,853	295,935,805	301,435,777	c 301,435,777
Philippine Islands	Jan. 1	188,114,307	191,917,567	239,196,273	285,393,647	282,006,295
Reunion	Jan. 1	107,862,584	80,432,029	41,433,135	80,424,062	c 80,424,062
Russia	Jan. 1	540,418,988	398,854,898	220,925,074	214,041,360	b 244,158,641
Trinidad and Tobago	Apr. 1	90,460,944	106,573,936	81,179,056	100,809,856	201,368,272
Other countries	....	595,803,000	537,578,000	948,358,615	1,093,894,758	b 982,469,513
Total	....	11,663,618,726	11,638,553,768	11,636,859,137	13,601,658,410	13,085,417,108

a See "General note," p. 605.
b Preliminary.
c Year preceding.
d Not including free ports prior to Mar. 1, 1906.

International trade in sugar, 1903–1907—Continued.

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Australia	Jan. 1	205,026,640	85,198,624	55,923,056	94,026,128	13,815,312
British India	Jan. 1	607,099,024	776,046,880	666,139,936	1,222,706,352	1,073,977,072
Canada	Jan. 1	367,259,074	390,334,614	388,668,153	461,635,652	444,983,523
Cape of Good Hope [a]	Jan. 1	104,629,048	101,468,941	82,805,094	112,856,109	106,466,060
Chile	Jan. 1	115,467,959	124,139,619	75,610,563	118,266,828	124,648,777
China	Jan. 1	435,711,467	509,959,200	626,433,333	872,765,600	782,549,467
Denmark	Jan. 1	77,374,516	82,865,127	76,080,072	45,254,827	53,083,219
Egypt	Jan. 1	16,920,099	45,843,510	86,880,895	76,321,099	54,872,620
Finland	Jan. 1	72,691,465	71,263,531	73,772,007	83,322,752	87,648,875
France	Jan. 1	288,073,883	179,849,557	179,460,755	222,562,321	[b] 235,292,692
Italy	Jan. 1	14,477,532	4,928,873	11,251,729	31,832,317	[b] 52,332,876
Japan	Jan. 1	523,131,067	547,300,400	289,129,733	504,816,933	439,518,000
Netherlands	Jan. 1	203,061,092	208,329,129	167,742,700	121,994,196	196,542,746
New Zealand	Jan. 1	88,197,686	91,841,944	89,439,230	93,329,376	118,135,248
Norway	Jan. 1	83,524,155	76,703,054	77,993,596	80,364,138	87,092,424
Persia	Mar. 21	179,412,238	154,815,921	154,217,415	209,477,168	[c] 209,477,168
Portugal	Jan. 1	68,765,610	72,490,231	70,011,389	72,092,109	[c] 72,092,109
Singapore	Jan. 1	102,369,867	114,407,600	117,958,267	134,471,066	[c] 134,471,066
Switzerland	Jan. 1	192,015,742	175,444,701	192,011,994	187,653,456	205,551,900
Turkey	Jan. 1	[d] 273,612,826	[d] 273,612,826	[d] 273,612,826	302,621,963	[c] 302,621,963
United Kingdom	Jan. 1	3,099,985,504	3,409,501,648	3,099,597,648	3,420,616,976	3,535,722,624
United States	Jan. 1	3,328,873,478	4,137,696,178	3,737,336,660	3,873,665,661	3,872,221,493
Uruguay	July 1	39,934,265	49,814,318	33,838,445	47,969,665	[c] 47,969,665
Other countries	....	361,216,365	383,920,681	584,221,838	442,395,418	[b] 543,890,021
Total	....	10,848,830,602	12,067,777,107	11,210,137,334	12,833,018,110	12,794,976,920

[a] British South Africa after 1905.
[b] Preliminary.
[c] Year preceding.
[d] Imports for 1899.

TEA.

International trade in tea, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
British India	Jan. 1	206,366,075	213,645,718	210,784,504	235,340,922	233,231,921
Ceylon	Jan. 1	149,227,236	157,929,342	170,183,558	170,527,126	179,844,827
China	Jan. 1	223,670,667	193,499,867	182,573,067	187,217,067	214,683,333
Dutch East Indies	Jan. 1	21,333,166	26,011,407	26,143,823	26,516,239	29,835,482
Formosa	Jan. 1	23,949,974	21,735,627	23,779,051	23,018,508	22,975,068
Japan	Jan. 1	47,858,393	47,108,802	38,565,730	39,636,497	40,589,420
Singapore	Jan. 1	1,955,067	2,752,933	2,411,600	2,396,667	[b] 2,396,667
Other countries	....	4,692,000	5,428,000	7,721,353	29,172,988	[c] 5,499,685
Total	....	679,052,578	668,111,696	662,162,686	713,826,014	729,056,403

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Argentina	Jan. 1	1,798,310	2,418,217	2,314,238	2,875,363	2,833,671
Australia	Jan. 1	24,716,426	28,688,974	28,353,903	29,478,614	35,174,152
Austria-Hungary	Jan. 1	2,364,457	2,662,742	2,755,998	2,859,615	[c] 3,090,660
British India	Jan. 1	6,013,626	5,584,103	6,669,868	5,426,731	5,965,738
Canada	Jan. 1	27,474,789	29,817,658	23,876,200	26,476,892	28,840,872
Cape of Good Hope [d]	Jan. 1	3,793,311	3,322,815	3,254,298	4,823,363	4,613,177
Chile	Jan. 1	1,977,766	1,760,202	2,496,479	2,904,127	2,380,893
Dutch East Indies	Jan. 1	4,458,883	4,044,820	4,962,110	5,113,929	[b] 5,113,929
France	Jan. 1	2,249,722	2,446,200	2,348,152	2,519,330	[c] 2,547,000
French Indo-China	Jan. 1	2,947,659	3,436,080	2,314,783	2,399,784	[b] 2,399,784
Germany [e]	Jan. 1	6,805,889	7,168,769	6,900,908	8,675,188	8,680,920
Netherlands	Jan. 1	7,926,262	8,794,208	9,090,607	9,559,206	9,202,811
New Zealand	Jan. 1	5,232,721	5,225,668	5,898,391	6,140,842	6,771,169
Persia	Mar. 1	6,922,170	5,784,277	6,997,776	5,410,358	[b] 5,410,358
Russia	Jan. 1	132,670,193	121,648,892	117,506,248	207,529,861	[c] 158,374,671
Singapore	Jan. 1	4,243,467	4,602,533	4,760,800	4,992,267	[b] 4,992,267
United Kingdom	Jan. 1	255,498,148	256,660,268	259,090,380	270,123,489	273,984,050
United States	Jan. 1	103,083,198	106,791,122	96,779,145	89,437,757	99,117,343
Other countries	....	15,889,000	10,989,000	32,326,198	32,070,924	[c] 37,936,610
Total	....	616,065,997	611,846,648	618,696,482	718,817,640	697,430,075

[a] See "General note," p. 605.
[b] Year preceding.
[c] Preliminary.
[d] British South Africa after 1905.
[e] Not including free ports prior to Mar. 1, 1906.

COFFEE.

International trade in coffee, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Brazil	Jan. 1	1,709,984,152	1,326,027,795	1,431,343,492	1,847,367,771	2,076,538,004
British India	Jan. 1	38,965,024	29,754,928	41,138,720	36,584,688	17,866,128
Colombia [b]	Jan. 1	100,000,000	130,000,000	70,000,000	70,000,000	70,000,000
Costa Rica	Sept. 1	38,211,860	27,730,672	39,788,002	30,367,032	38,195,076
Dutch East Indies	Jan. 1	116,334,830	77,168,254	72,864,649	75,761,218	[c] 75,761,218
Guatemala	Jan. 1	63,150,500	71,653,700	82,241,067	69,289,369	99,740,000
Haiti	Oct. 1	47,853,529	81,407,346	38,853,718	59,824,869	[c] 59,824,869
Jamaica	Apr. 1	8,966,832	5,781,440	9,046,464	6,144,432	10,551,072
Mexico	Jan. 1	39,430,873	40,268,455	47,182,496	37,568,983	29,980,000
Netherlands	Jan. 1	181,196,786	166,468,567	148,744,186	161,617,580	177,012,048
Nicaragua	Jan. 1	18,431,643	21,661,621	18,171,515	19,418,928	[c] 19,418,928
Salvador	July 1	58,097,158	75,314,003	75,532,268	72,655,523	[c] 72,655,523
Singapore	Jan. 1	15,125,067	10,638,667	7,813,067	7,860,533	[c] 7,860,533
United States	Jan. 1	33,677,870	25,568,821	21,777,960	32,821,342	41,802,527
Venezuela	July 1	125,582,423	86,950,323	94,370,089	99,200,810	99,200,810
Other countries	....	35,370,000	61,615,000	79,006,551	60,085,421	[d] 60,070,854
Total	....	2,630,378,547	2,238,009,592	2,277,874,244	2,686,568,499	2,956,477,590

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Argentina	Jan. 1	18,502,868	16,931,049	18,516,812	20,229,490	21,625,655
Austria-Hungary	Jan. 1	104,200,357	108,701,092	107,106,048	112,841,372	[d] 31,905,180
Belgium	Jan. 1	51,859,425	154,387,057	100,032,285	119,040,964	250,282,012
Cape of Good Hope [e]	Jan. 1	20,979,803	19,448,590	21,136,170	26,862,060	23,686,674
Cuba	Jan. 1	17,218,114	20,716,876	23,916,707	21,357,127	23,250,864
Denmark	Jan. 1	24,369,892	25,552,671	21,220,589	23,148,531	23,477,020
Egypt	Jan. 1	13,196,168	12,789,537	13,906,858	18,401,914	14,976,566
Finland	Jan. 1	25,598,739	23,291,871	25,743,433	29,085,091	29,007,779
France	Jan. 1	246,122,708	168,198,472	200,594,621	215,713,162	[d] 223,928,700
Germany [f]	Jan. 1	403,070,820	398,486,529	398,491,379	411,815,012	418,373,762
Italy	Jan. 1	38,934,065	39,087,728	41,287,279	45,046,159	[d] 47,356,824
Netherlands	Jan. 1	259,525,128	193,836,257	206,246,193	255,731,280	259,830,047
Norway	Jan. 1	27,996,473	23,699,731	25,311,450	28,250,644	28,838,572
Russia	Jan. 1	21,320,455	20,976,264	21,691,262	23,584,331	[d] 24,990,058
Singapore	Jan. 1	14,958,400	9,174,666	7,784,667	8,524,000	[c] 8,524,000
Spain	Jan. 1	21,851,660	22,000,781	24,084,186	28,518,089	24,944,160
Sweden	Jan. 1	68,349,071	60,623,344	66,417,080	77,507,951	71,117,600
Switzerland	Jan. 1	23,671,026	22,562,322	20,958,680	24,885,994	25,202,136
United Kingdom	Jan. 1	30,107,938	28,845,095	28,852,729	28,640,738	29,242,982
United States	Jan. 1	974,238,424	1,112,709,546	893,889,352	857,013,585	940,247,312
Other countries	....	79,152,000	48,415,000	80,777,562	78,324,516	[d] 79,561,239
Total	....	2,485,223,534	2,530,434,478	2,348,055,342	2,454,522,010	2,600,369,142

[a] See "General note," p. 605.
[b] Estimated.
[c] Year preceding.
[d] Preliminary.
[e] Imports of British South Africa after 1905.
[f] Not including free ports prior to Mar. 1, 1906.

OIL CAKE AND OIL-CAKE MEAL.

International trade in oil cake and oil-cake meal, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	19,989,308	29,019,439	29,277,380	29,524,298	26,703,310
Austria-Hungary	Jan. 1	88,614,781	92,352,938	77,134,433	78,843,897	[b] 92,060,385
Belgium	Jan. 1	137,066,773	145,834,669	160,163,061	176,470,002	146,626,113
British India	Jan. 1	132,527,584	151,975,264	180,575,696	105,207,200	127,575,168
Canada	Jan. 1	31,841,000	17,197,800	9,190,800	34,803,800	44,286,700
China	Jan. 1	89,672,067	83,999,467	95,344,667	120,944,400	132,974,800
Denmark	Jan. 1	8,682,295	4,417,928	5,676,571	3,101,969	4,889,005
Egypt	Jan. 1	156,944,836	160,794,106	147,961,001	164,142,926	145,538,121
France	Jan. 1	314,693,035	351,628,964	339,529,396	323,482,202	[b] 312,262,881
Germany [c]	Jan. 1	375,254,222	436,964,238	397,800,450	361,592,621	396,195,045
Italy	Jan. 1	19,627,750	24,696,396	24,425,228	12,617,052	[b] 16,882,334
Netherlands	Jan. 1	136,734,208	154,525,289	143,290,470	147,620,993	206,333,847
Russia	Jan. 1	1,028,500,994	1,084,331,094	977,376,790	1,155,869,540	[b] 1,100,032,001
United Kingdom	Jan. 1	53,146,240	48,462,400	57,830,080	58,524,480	49,669,760
United States	Jan. 1	1,630,897,491	1,650,379,342	1,861,577,352	1,929,901,354	1,959,101,228
Other countries		28,044,246	57,906,820	100,683,961	124,546,370	[b] 138,980,712
Total		4,252,236,830	4,494,486,154	4,607,837,336	4,827,193,104	4,900,120,410

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Austria-Hungary	Jan. 1	21,750,580	27,340,840	26,469,794	24,769,590	[b] 35,742,434
Belgium	Jan. 1	421,696,899	445,202,134	448,216,564	510,213,668	423,941,798
Canada	Jan. 1	3,551,000	2,671,500	3,606,600	1,889,700	4,290,000
Denmark	Jan. 1	776,875,723	757,481,664	842,875,492	843,140,047	947,748,259
Dutch East Indies	Jan. 1	15,977,041	31,004,951	19,075,498	26,850,775	[d] 26,850,775
Finland	Jan. 1	7,205,192	13,948,954	11,179,475	14,543,404	23,857,077
France	Jan. 1	279,980,299	292,015,079	323,719,234	237,725,713	[b] 247,736,240
Germany [c]	Jan. 1	1,108,355,853	1,231,409,255	1,285,529,859	1,325,622,674	1,573,607,155
Italy	Jan. 1	9,645,221	6,525,902	5,209,963	7,851,541	[b] 10,575,792
Japan	Jan. 1	78,582,800	82,023,067	110,074,533	134,060,451	162,850,133
Netherlands	Jan. 1	476,967,295	495,921,130	510,951,427	564,097,473	639,972,913
Sweden	Jan. 1	163,933,913	219,913,686	226,374,498	264,890,580	317,805,100
United Kingdom	Jan. 1	811,798,400	823,934,720	797,368,320	797,115,200	731,057,600
Other countries		25,778,496	54,135,136	153,440,166	143,088,371	[b] 162,410,312
Total		4,202,098,712	4,483,528,018	4,764,091,423	4,895,859,187	5,308,445,588

[a] See "General note," p. 605.
[b] Preliminary.
[c] Not including free ports prior to Mar. 1, 1906.
[d] Year preceding.

FLAX.

Flax crop of countries named, 1905–1907.

Country.	Seed.			Fiber.		
	1905.	1906.	1907.	1905.	1906.	1907.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*
United States	28,478,000	25,576,000	25,851,000			
Canada:						
Manitoba	337,000	283,000	317,000			
Saskatchewan	411,000	733,000	1,365,000			
Alberta	9,000	40,000	50,000			
Total Canada	757,000	1,056,000	1,732,000			
Mexico	150,000	150,000	150,000			
Total North America	29,385,000	26,782,000	27,733,000			
SOUTH AMERICA.						
Argentina	29,133,000	23,303,000	32,509,000			
Uruguay	553,000	424,000	863,000			
Total South America	29,686,000	23,727,000	33,372,000			
EUROPE.						
Austria-Hungary:						
Austria	1,370,000	1,375,000	1,239,000	123,127,000	128,141,000	102,168,000
Hungary proper	229,000	200,000	160,000	24,510,000	25,000,000	20,000,000
Croatia-Slavonia	29,000	30,000	23,000	9,653,000	10,000,000	8,000,000
Bosnia-Herzegovina	3,000	4,000	3,000	1,428,000	1,479,000	1,000,000
Total Austria-Hungary	1,631,000	1,609,000	1,425,000	158,718,000	164,620,000	131,168,000
Belgium	280,000	294,000	300,000	25,534,000	26,843,000	27,000,000
Bulgaria	4,000	6,000	2,000	289,000	473,000	64,000
France	575,000	646,000	613,000	45,515,000	46,109,000	44,046,000
Ireland				24,353,000	26,935,000	26,089,000
Italy [a]				41,917,000	41,917,000	41,917,000
Netherlands	437,000	365,000	392,000	18,440,000	21,947,000	26,318,000
Roumania	335,000	571,000	159,000	2,905,000	6,978,000	5,018,000
Russia:						
Russia proper	20,981,000	17,254,000	19,176,000	1,024,557,000	1,358,287,000	1,583,201,000
Poland	819,000	911,000	925,000	47,420,000	69,524,000	70,000,000
Northern Caucasia	511,000	366,000	467,000	23,665,000	23,119,000	26,000,000
Total Russia (European)	22,311,000	18,531,000	20,568,000	1,095,642,000	1,450,930,000	1,679,201,000
Servia				905,000	1,543,000	1,601,000
Sweden	33,000	30,000	22,000	2,003,000	1,795,000	1,425,000
Total Europe	25,606,000	22,052,000	23,481,000	1,416,221,000	1,790,090,000	1,983,847,000
ASIA.						
British India, including such native States as report	13,896,000	14,128,000	17,008,000			
Russia:						
Central Asia	1,024,000	721,000	[b]545,000	26,914,000	27,607,000	27,000,000
Siberia	649,000	615,000	581,000	38,260,000	45,371,000	44,430,000
Transcaucasia	195,000	108,000	150,000	12,834,000	8,833,000	10,000,000
Total Russia (Asiatic)	1,868,000	1,444,000	1,276,000	78,008,000	81,811,000	81,430,000
Total Asia	15,764,000	15,572,000	18,284,000	78,008,000	81,811,000	81,430,000
AFRICA.						
Algeria	17,000	17,000	12,000			
Grand total	100,458,000	88,150,000	102,882,000	1,494,229,000	1,871,901,000	2,065,277,000

[a] Average, 1892–1895. [b] Incomplete returns.

ROSIN.

International trade in rosin, 1903-1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	3,327,436	3,627,485	3,372,410	3,154,594	3,019,450
Germany[b]	Jan. 1	44,552,765	45,617,597	46,370,255	46,088,946	55,019,208
Netherlands	Jan. 1	63,038,801	83,943,225	58,544,509	79,550,046	76,673,653
United States	Jan. 1	717,913,560	700,425,880	632,275,280	694,755,320	738,121,720
Other countries	....	373,000	338,000	675,870	18,210,324	[c]19,891,316
Total	....	829,205,562	833,952,187	741,238,324	841,759,230	892,725,347

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Argentina	Jan. 1	19,761,229	27,846,666	20,409,438	22,957,066	23,206,173
Australia	Jan. 1	8,989,904	15,552,880	14,037,408	10,326,800	15,618,176
Austria-Hungary	Jan. 1	72,122,004	64,824,926	62,482,294	73,355,049	[c]74,317,587
Brazil	Jan. 1	26,729,827	26,297,077	27,492,124	21,608,739	26,830,250
Canada	Jan. 1	16,029,100	26,071,000	18,907,000	19,167,200	21,856,300
Chile	Jan. 1	3,844,971	1,935,923	2,108,756	3,536,588	3,173,882
Cuba	Jan. 1	2,963,173	2,184,454	1,760,478	1,536,070	[d]1,536,070
Denmark	Jan. 1	1,630,318	2,135,176	2,033,764	2,326,979	2,439,414
Finland	Jan. 1	4,397,180	3,389,950	5,133,632	3,893,252	7,509,485
Germany[b]	Jan. 1	[e]236,486,054	[e]233,541,561	[e]208,295,553	[e]235,300,629	[e]247,632,623
Italy	Jan. 1	25,020,035	32,527,875	27,539,477	32,796,618	[c]33,591,825
Japan	Jan. 1	3,275,449	5,463,167	6,378,787	6,599,144	7,120,409
Netherlands	Jan. 1	68,258,334	89,756,661	78,666,949	80,488,983	90,920,593
Russia	Jan. 1	67,526,025	65,493,091	59,632,597	60,581,028	[c]67,458,710
Servia	Jan. 1	6,751,840	4,887,332	7,894,169	1,371,797	4,562,763
Spain	Jan. 1	4,823,960	3,983,117	3,684,871	4,696,182	[c]5,235,386
Sweden	Jan. 1	9,940,220	13,440,652	11,443,057	13,110,667	12,885,520
Switzerland	Jan. 1	6,297,062	6,640,101	5,736,867	5,306,746	5,271,031
United Kingdom	Jan. 1	183,607,872	199,577,952	177,010,624	174,996,752	177,534,336
Uruguay	July 1	4,390,394	5,693,582	4,881,232	[f]4,881,232	[f]4,881,232
Other countries	....	8,904,253	12,775,980	13,005,454	27,285,931	[c]24,493,844
Total	....	781,749,204	844,019,123	758,534,531	806,123,452	858,075,609

[a] See "General note," p. 605.
[b] Not including free ports prior to Mar. 1, 1906.
[c] Preliminary.
[d] Year preceding.
[e] Including turpentine.
[f] Figures for 1905.

TURPENTINE.

International trade in spirits of turpentine, 1903-1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
France	Jan. 1	1,975,963	1,459,297	3,179,105	3,367,371	[b]2,986,773
Germany[c]	Jan. 1	612,058	569,650	520,750	460,735	349,555
Netherlands	Jan. 1	988,059	876,929	972,714	1,400,645	1,675,788
Russia	Jan. 1	1,887,430	2,163,759	2,504,423	1,804,858	[b]1,830,718
United States	Jan. 1	15,651,937	16,426,756	15,614,323	16,182,500	17,176,843
Other countries	....	71,979	112,536	89,867	105,869	[b]1,001,272
Total	....	21,187,426	21,608,927	22,881,182	23,321,978	25,020,949

[a] See "General note," p. 605. [b] Preliminary. [c] Not including free ports prior to Mar. 1, 1906.

International trade in spirits of turpentine, 1903–1907—Continued.

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Argentina	Jan. 1	276,360	344,877	290,804	570,426	521,857
Australia	Jan. 1	226,272	437,032	291,809	377,650	522,656
Austria-Hungary	Jan. 1	1,739,722	2,071,855	2,021,485	2,218,095	[a] 2,290,020
Canada	Jan. 1	741,594	758,513	789,886	842,525	857,232
Chile	Jan. 1	163,911	85,896	136,124	173,918	207,237
Germany [b]	Jan. 1	8,300,249	8,438,956	8,539,910	9,966,790	8,986,101
Italy	Jan. 1	771,465	816,629	687,291	948,171	[a] 921,287
Netherlands	Jan. 1	2,729,815	2,220,156	2,248,055	2,711,797	3,036,027
New Zealand	Jan. 1	69,596	285,631	153,999	158,399	145,808
Russia	Jan. 1	201,133	204,734	192,902	314,342	[a] 326,018
Sweden	Jan. 1	126,194	138,884	115,383	141,077	146,202
Switzerland	Jan. 1	360,303	372,367	346,279	462,297	40,482
United Kingdom	Jan. 1	8,012,184	7,907,418	7,693,933	7,673,758	7,515,293
Other countries		506,056	584,163	711,974	1,884,017	[a] 1,590,172
Total		24,224,854	24,667,111	24,219,834	28,443,262	27,106,392

[a] Preliminary. [b] Not including free ports prior to Mar. 1, 1906.

INDIA RUBBER.

International trade in india rubber, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Angola	Jan. 1	6,137,046	5,617,377	[b] 5,200,000	[b] 5,200,000	[b] 5,200,000
Belgium	Jan. 1	14,088,566	16,335,876	14,997,420	16,940,908	13,886,021
Bolivia	Jan. 1	2,912,381	4,915,638	3,728,726	[c] 3,728,726	[c] 3,728,726
Brazil	Jan. 1	69,923,121	70,251,499	78,027,329	77,073,991	80,447,181
Dutch East Indies	Jan. 1	1,475,551	3,590,489	4,569,275	4,564,932	[d] 4,564,932
Ecuador	Jan. 1	1,090,988	1,145,447	1,293,134	1,394,575	1,031,510
France	Jan 1	6,390,101	6,632,627	10,766,377	13,033,578	[e] 14,499,799
French Guinea	Jan. 1	3,280,045	2,952,245	3,121,366	3,374,026	[d] 3,374,026
French Kongo	Jan. 1	1,857,491	2,753,778	3,716,860	4,310,082	[d] 4,310,082
Germany [f]	Jan. 1	11,237,840	10,073,138	18,654,850	19,887,013	19,282,947
Gold Coast Colony	Jan. 1	2,258,981	4,013,837	3,687,778	3,649,668	3,549,548
Ivory Coast	Jan. 1	2,572,379	3,386,399	2,602,638	3,347,895	[d] 3,347,895
Kamerun	Jan. 1	1,822,144	1,920,354	2,141,777	2,537,540	3,291,084
Kongo Free State	Jan. 1	[b] 13,350,000	[b] 10,040,000	10,718,358	10,690,060	10,266,314
Netherlands	Jan. 1	3,231,008	3,998,071	5,760,814	5,605,388	4,121,106
Peru	Jan. 1	4,648,000	4,896,298	5,598,785	5,678,357	[d] 5,678,357
Senegal	Jan. 1	1,801,957	2,208,623	2,242,786	2,618,511	[d] 2,618,511
Singapore	Jan. 1	1,441,200	3,026,133	5,053,067	5,888,000	[d] 5,888,000
Southern Nigeria Protectorate	Jan. 1	1,177,803	2,408,926	2,842,831	3,434,279	2,843,823
Venezuela	July 1	114,030	109,440	219,693	369,100	[d] 369,100
Other countries		5,709,897	8,644,052	11,714,817	18,266,180	[e] 26,599,959
Total		156,520,529	168,920,847	196,658,681	211,592,809	218,898,921

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Austria-Hungary	Jan. 1	2,789,508	2,935,675	3,021,875	4,231,331	[e] 4,898,670
Belgium	Jan. 1	16,977,346	17,983,033	18,744,212	20,813,089	18,292,494
Canada	Jan. 1	3,018,025	3,236,574	2,504,217	2,542,580	2,777,668
France	Jan. 1	12,708,795	14,611,040	19,693,018	23,053,199	[e] 27,415,356
Germany [f]	Jan. 1	34,362,782	38,375,855	47,627,110	51,488,947	50,348,055
Italy	Jan. 1	1,470,042	1,474,451	1,690,725	2,586,242	2,241,660
Netherlands	Jan. 1	4,422,234	5,371,310	6,645,498	8,189,950	8,142,875
Russia	Jan. 1	14,388,134	13,064,780	12,913,540	16,702,892	[e] 15,022,925
United Kingdom	Jan. 1	16,784,992	22,140,048	29,000,832	31,004,400	35,646,016
United States	Jan. 1	55,744,120	61,889,758	64,147,701	67,907,251	68,653,291
Other countries		3,865,408	8,050,120	9,278,344	11,639,538	[e] 11,011,433
Total		166,531,386	189,132,644	215,267,072	240,159,419	244,450,443

[a] See "General note," p. 605.
[b] Estimated.
[c] Figures for 1905.
[d] Year preceding.
[e] Preliminary.
[f] Not including free ports prior to Mar. 1, 1906.

SILK.

Raw silk production of countries named, 1903–1907.

[Estimate of the Silk Manufacturers' Association of Lyons.]

Country.	1903.	1904.	1905.	1906.	1907.
Western Europe:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Italy	7,774,000	10,803,000	9,788,000	10,461,000	10,626,000
France	1,045,000	1,378,000	1,393,000	1,333,000	1,460,000
Spain	190,000	170,000	172,000	124,000	181,000
Austria-Hungary	606,000	694,000	761,000	754,000	761,000
Total	9,615,000	13,045,000	12,114,000	12,672,000	13,028,000
Levant and Central Asia:					
Anatolia	1,160,000	1,096,000	1,424,000	1,221,000	1,327,000
Syria and Cyprus	1,124,000	1,036,000	1,080,000	1,037,000	1,179,000
Other provinces of Asiatic Turkey	....	....	....	....	322,000
Salonica and Adrianople	547,000	564,000	617,000	567,000	754,000
Balkan States	300,000	337,000	419,000	408,000	496,000
Greece and Crete	132,000	143,000	155,000	165,000	168,000
Caucasus	882,000	794,000	640,000	1,003,000	1,085,000
Persia and Turkestan (exports)	1,433,000	939,000	1,014,000	1,385,000	1,340,000
Total	5,578,000	4,909,000	5,349,000	5,786,000	6,671,000
Far East:					
China—					
Exports from Shanghai	9,356,000	9,293,000	8,841,000	9,396,000	9,160,000
Exports from Canton	4,733,000	4,705,000	4,409,000	4,325,000	4,960,000
Japan—					
Exports from Yokohama	10,159,000	12,846,000	10,183,000	13,210,000	14,043,000
British India—					
Exports from Calcutta and Bombay [a]	540,000	397,000	617,000	717,000	772,000
Total	24,788,000	27,241,000	24,050,000	27,648,000	28,935,000
Grand total	39,981,000	45,195,000	41,513,000	46,106,000	48,634,000

[a] Exports from Bombay included for the first time in 1905.

BEANS.

Wholesale prices of beans per bushel, 1897–1908.

Date.	Boston.		Cincinnati.		Chicago.		Detroit.		San Francisco.	
	Pea.		Navy.		Pea.		Pea.		Small white (per cwt.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1897	....	....	$0.70	$1.20	$0.35	$1.25	$0.60	$1.05	....	....
1898	....	....	1.10	1.55	.78	1.30	.90	1.30	$1.25	$2.20
1899	....	....	1.05	1.75	.90	1.87	1.01	1.80	2.00	3.00
1900	....	....	2.00	2.55	1.65	2.25	1.55	2.10	2.85	4.50
1901	$2.00	$2.75	2.40	3.00	.90	2.80	1.66	2.40	2.00	5.00
1902	1.60	2.55	2.20	2.70	.85	2.49	1.28	1.98	3.30	4.65
1903	2.10	2.45	2.05	2.50	.90	2.40	1.82	2.35	2.40	3.40
1904	1.72½	2.20	1.80	2.10	.90	2.05	1.58	1.98	2.75	3.32½
1905.										
January	1.75	1.75	1.80	1.90	1.25	1.62	1.56	1.65	2.75	3.30
February	1.75	2.00	1.80	1.90	1.00	1.85	1.52	1.85	2.75	3.30
March	1.80	1.97	1.80	1.90	1.30	1.80	1.70	1.77	2.75	3.45
April	1.75	1.80	1.80	1.90	1.30	1.70	1.66	1.75	2.75	3.45
May	1.75	1.80	1.80	1.90	1.30	1.70	1.62	1.68	2.75	3.40
June	1.80	1.90	1.80	1.90	1.30	1.75	1.65	1.69	2.75	3.50
July	1.85	1.90	1.80	1.90	1.25	1.78	1.66	1.68	2.75	3.60
August	1.75	1.85	1.80	1.90	1.20	1.72½	1.55	1.63	2.75	3.60
September	1.75	1.75	1.80	1.90	1.25	1.68	1.50	1.65	3.00	3.60
October	1.75	1.75	1.65	1.75	1.25	1.65	1.49	1.63	3.00	3.60
November	1.75	1.85	1.65	1.75	1.40	1.70	1.55	1.68	2.75	3.15
December	1.75	1.85	1.65	1.75	1.40	1.70	1.55	1.65	2.75	3.20
1906.										
January	1.75	1.80	1.65	1.75	1.40	1.62	1.55	1.61	....	....
February	1.65	1.75	1.65	1.75	1.37	1.58	1.45	1.55	....	....
March	1.55	1.60	1.65	1.75	1.35	1.55	1.40	1.47	....	....
April	1.60	1.65	1.65	1.75	1.10	1.62	1.44	1.52	....	....
May	1.60	1.70	1.65	1.75	1.20	1.62	1.48	1.54	....	....
June	1.60	1.72	1.65	1.75	1.25	1.65	1.48	1.55	....	....
July	1.60	1.62	1.65	1.75	1.25	1.64	1.50	1.52	....	....
August	1.55	1.60	1.65	1.75	1.25	1.58	1.41	1.50	....	....
September	1.50	1.55	1.65	1.75	1.39	1.53	1.30	1.44	....	....
October	1.55	1.65	1.65	1.75	1.40	1.48	1.37	1.40	....	....
November	1.60	1.65	1.65	1.75	1.40	1.46	1.34	1.37	....	....
December	1.50	1.55	1.65	1.75	1.35	1.45	1.27	1.30	....	....
1907.					(a)					
January	1.50	1.50	1.65	1.75	1.20	1.38	1.28	1.31	2.60	2.95
February	1.50	1.55	1.65	1.70	1.10	1.39	1.31	1.36	2.60	3.00
March	1.45	1.55	1.65	1.70	1.10	1.36	1.30	1.36	2.75	3.00
April	1.42	1.47	1.65	1.75	1.10	1.35	1.32	1.36	2.85	3.10
May	1.45	1.90	1.65	1.75	1.10	1.77	1.38	1.73	2.80	3.05
June	1.80	1.90	1.65	1.75	1.55	1.83	1.64	1.74	2.80	3.00
July	1.70	1.75	1.65	1.70	1.15	1.68	1.50	1.65	2.75	3.00
August	1.70	1.80	1.65	1.70	1.15	1.85	1.48	1.60	2.85	3.00
September	1.90	2.25	1.65	1.70	1.35	2.25	1.75	2.06	2.85	3.15
October	2.35	2.45	1.65	1.70	1.85	2.40	2.00	2.25	3.00	3.60
November	2.45	2.45	1.65	2.25	1.85	2.65	1.90	2.10	3.40	3.60
December	2.30	2.40	2.00	2.25	1.85	2.15	1.90	2.00	3.40	3.55
1908.					(b)					
January	2.30	2.35	2.00	2.25	1.85	2.15	2.00	2.10	3.40	3.55
February	2.35	2.40	2.00	2.25	1.75	2.40	2.10	2.30	3.40	3.60
March	2.30	2.40	2.25	2.40	1.80	2.40	2.10	2.25	3.40	3.60
April	2.35	2.45	2.30	2.40	1.65	2.32	2.25	2.42	3.40	3.60
May	2.60	2.75	2.30	2.40	1.65	2.70	2.42	2.55	3.50	4.35
June	2.65	2.75	2.30	2.40	2.00	2.70	2.47	2.60	4.20	4.50
July	2.65	2.70	2.30	2.40	2.00	2.65	2.40	2.65	4.35	4.60
August	2.60	2.70	2.30	2.40	1.90	2.54	2.50	2.65	4.60	4.75
September	2.35	2.60	2.30	2.40	1.75	2.40	2.05	2.40	4.25	4.75
October	2.35	2.40	2.30	2.40	1.75	2.40	2.10	2.18	4.00	4.50
November	2.40	2.40	2.30	2.40	1.75	2.25	2.10	2.20	4.30	4.65
December	2.35	2.40	2.30	2.40	1.75	2.27	2.15	2.15	4.35	4.70

[a] Common to fine. [b] Pea.

FARM ANIMALS AND THEIR PRODUCTS.

[Figures furnished by the Bureau of Statistics, Department of Agriculture, except where otherwise credited. All prices on gold basis.]

Live stock of countries named.

[Africa incompletely represented, through lack of statistics for large areas. Number of animals in China, Persia, Afghanistan, Korea, Bolivia, Ecuador, Salvador, and several less important countries unknown. For Brazil number of cattle alone estimated, but roughly. In general, statistics of cattle, horses, sheep, and swine much more complete than those of other animals, as statements for the world.]

Country.	Year.	Cattle.		Horses.	Mules	Sheep.	Swine.
		Total.	Dairy cows.				
NORTH AMERICA.							
United States:							
Contiguous—							
On farms	1909	71,099,000	21,720,000	20,640,000	4,053,000	56,084,000	54,147,000
Not on farms	1900	1,616,422	973,033	2,936,881	173,908	231,301	1,818,114
Noncontiguous—							
Alaska [a]	1900	18	13	5	....	....	10
Hawaii [a]	1900	102,908	4,028	12,982	6,506	102,098	8,057
Porto Rico	1899	260,225	73,372	58,664	6,985	6,363	66,180
Total United States (except Philippine Islands)	......	73,078,573	22,770,446	23,648,532	4,240,399	56,423,762	56,039,361
Bermuda	1907	....	....	[b] 1,082	....	....	....
Canada:							
Prince Edward Island	1908	113,145	52,650	34,809	....	113,206	49,692
Nova Scotia	1908	338,570	147,603	67,857	....	373,392	74,063
New Brunswick	1908	250,500	127,419	67,100	....	230,502	98,062
Ontario	1908	3,217,938	1,301,840	849,029	....	1,205,630	1,947,183
Quebec	1908	1,553,539	884,896	361,711	....	600,092	751,336
Manitoba	1908	531,534	173,546	230,926	....	29,265	192,489
Saskatchewan	1908	497,623	119,375	259,811	....	116,438	141,264
Alberta	1908	1,044,683	110,357	246,922	....	161,979	115,769
British Columbia	1901	125,002	24,535	37,325	....	33,350	41,419
Total Canada	......	7,072,534	2,942,281	2,155,490	....	2,864,754	3,411,277
Central America:							
Guatemala	1898	196,768	....	50,343	....	77,593	29,784
Honduras	1907	600,000	....	45,000	15,000	15,000	120,000
Nicaragua	......	1,200,000	....	....	....	....	....
Panama	1907	65,000	....	17,000	1,500	....	28,000
Costa Rica	1905	308,160	[c] 93,155	54,974	2,987	250	79,730
Mexico	1902	5,142,457	....	859,217	334,435	3,424,430	616,139
Newfoundland	1901	32,767	....	8,851	....	78,052	34,679
West Indies:							
British—							
Barbados	1906	....	....	2,441	....	....	....
Dominica	1906	[d] 1,437	....	568	....	[d] 1,088	....
Grenada	1901	1,908	....	1,074	....	1,975	....
Jamaica	1907	105,045	....	50,063	....	14,664	29,500
Montserrat	1906	....	....	286	....	....	....
Turks and Caicos Islands	1906	800	....	105	....	125	....
Virgin Islands	1906	2,000	....	255	....	300	....
Cuba	1908	2,892,457	[e] 1,511,877	491,830	55,184	[f] 9,982	[f] 358,868
Dutch West Indies	1906	3,763	....	816	183	22,385	4,143
Guadeloupe	([g])	30,560	....	8,819	6,311	11,731	32,656
Total North America	......	91,334,279	....	27,396,746	4,655,999	62,946,091	60,784,137
SOUTH AMERICA.							
Argentina	1908	29,116,625	....	7,531,376	405,037	67,211,754	1,403,591
Brazil	......	30,000,000	....	....	....	....	....
British Guiana	1907	72,500	....	1,850	....	17,200	13,200
Chile	1906	2,477,064	[h] 124,657	698,880	[i] 27,936	2,405,584	287,612

[a] On farms.
[b] Including mules and asses.
[c] Cows in 1904.
[d] Data for 1903.
[e] Cows.
[f] Census for 1899.
[g] Official estimate furnished by the French embassy to the United States, under date of May 4, 1906.
[h] Data for 1904.
[i] Data for 1902.

Live stock of countries named—Continued.

Country.	Year.	Cattle.		Horses.	Mules.	Sheep.	Swine.
		Total.	Dairy cows.				
SOUTH AMERICA—con.							
Colombia	......	2,800,000	......	341,000	257,000	746,000	2,300,000
Dutch Guiana	1906	7,360	......	212	152	130	2,462
Falkland Islands	1907	4,500	......	3,000	......	695,747	100
Paraguay	1900	2,283,039	......	182,789	3,490	214,058	23,887
Uruguay	1900	6,827,428	......	561,408	22,992	18,608,717	93,923
Venezuela	1899	2,004,257	......	191,079	89,186	176,668	1,618,214
Total South America	......	75,592,773	......	9,511,594	865,793	90,075,858	5,742,989
EUROPE.							
Austria-Hungary:							
Austria	1900	9,511,170	[a] 4,749,152	1,716,488	20,323	2,621,026	4,682,654
Hungary	1895	6,605,365	[b] 3,499,724	2,308,457	1,911	8,122,682	7,330,343
Bosnia-Herzegovina	1895	[c] 1,417,341	......	[d] 239,626	......	3,230,720	662,242
Total Austria-Hungary	......	17,533,876	......	4,264,571	22,234	13,974,428	12,675,239
Belgium	[e] 1906	1,788,328	889,125	245,212	[f] 6,915	[g] 235,722	1,046,519
Bulgaria	1905	[h] 1,596,267	[i] 442,866	536,616	11,828	8,081,816	463,241
Denmark	1903	1,840,466	[a] 1,089,073	486,935	......	876,830	1,456,699
Faroe Islands	1903	3,950	......	632	......	91,034	15
Finland	1906	1,476,525	[a] 1,103,201	325,642	......	912,467	218,923
France	[e] 1908	13,949,722	[a] 7,336,214	3,094,698	191,715	17,460,284	6,995,124
Germany	1907	20,630,544	10,222,792	4,345,043	942	7,703,710	22,146,532
Gibraltar	1907	69	......	301	......	......	......
Greece	1902	406,744	......	159,068	88,869	4,568,158	79,716
Iceland	1906	26,159	......	48,908	......	549,563	......
Italy	1908	6,190,990	......	955,031	388,361	11,160,420	2,503,733
Luxemburg	1901	92,381	......	19,777	[j] 10	16,611	91,799
Malta	1908	7,060	......	3,835	3,456	14,063	5,724
Montenegro	......	60,000	[a] 20,000	3,000	......	400,000	8,000
Netherlands	1904	1,690,463	[k] 973,098	295,277	......	606,785	861,840
Norway	1900	950,201	[a] 689,563	172,999	......	998,819	165,348
Portugal	......	817,000	......	90,000	59,100	3,064,100	1,200,000
Roumania	1900	2,545,051	380,720	864,324	515	5,655,444	1,709,205
Russia:							
Russia proper	1908	30,800,826	......	20,934,415	......	[l] 38,048,736	9,953,973
Poland	1908	2,377,285	......	1,280,410	......	[l] 1,339,274	746,352
Northern Caucasia	1908	2,876,437	......	1,358,193	......	[l] 6,452,531	781,700
Total Russia, European	......	36,054,548	......	23,573,018	......	45,840,541	11,482,025
Servia	1905	969,953	[h] 153,359	174,363	739	3,160,166	908,108
Spain	1907	2,212,013	......	451,005	809,980	13,727,695	2,031,132
Sweden	1906	2,628,982	[a] 1,804,473	566,227	......	1,021,727	878,828
Switzerland	1906	1,498,144	[a] 785,950	135,372	3,153	209,997	548,970
Turkey	......	1,000,000	[a] 300,000	600,000	......	10,000,000	......
United Kingdom:							
Great Britain	1908	6,905,134	[m] 2,163,780	[n] 1,545,671	......	27,039,730	2,823,482
Ireland	1907	4,676,493	[m] 1,561,463	[n] 596,144	29,791	3,816,609	1,317,068
Isle of Man and Channel Islands	1907	41,582	[m] 18,039	[n] 9,556	......	79,769	13,329
Total United Kingdom	......	11,623,209	3,743,282	2,151,371	29,791	30,936,108	4,153,879
Total Europe	......	127,592,645	......	43,563,225	1,617.608	181,266,488	71,630,599

[a] Cows.
[b] Cows over 1 year old, including buffalo cows.
[c] Including buffaloes.
[d] Including mules and asses.
[e] On Dec. 31 of preceding year.
[f] Including asses; data for 1895.
[g] Data for 1895.
[h] Census, Dec. 31, 1900.
[i] Cows, census, Dec. 31, 1900.
[j] Including asses.
[k] Including cows kept for breeding purposes.
[l] Including goats.
[m] Cows and heifers in milk and with calf.
[n] Used for agriculture and also unbroken.

Live stock of countries named—Continued.

Country.	Year.	Cattle. Total.	Cattle. Dairy cows.	Horses.	Mules.	Sheep.	Swine.
ASIA.							
British India[a]	1907	[b]91,284,634	[c]26,734,705	1,463,293	55,966	[d]21,824,229	...
Ceylon	1907	1,559,271	...	3,985	...	98,746	96,305
Cochin China	1903	109,000	...	11,243	...	...	709,400
Cyprus	1908	57,696	...	[e]62,743	...	[f]277,230	36,075
Hongkong	1906	1,077	...	175	...	3	...
Japanese Empire:							
Japan	1906	1,190,373	...	1,465,466	...	3,501	284,708
Formosa	[g]1905	98,528	[c]39,295	68	...	...	976,327
Total Japanese Empire	...	1,288,901	...	1,465,534	...	3,501	1,261,035
Dutch East Indies:							
Java and Madura	1905	2,654,461	...	363,974	...	...	...
Other	1905	449,268	...	118,645	...	...	...
Total Dutch East Indies	...	3,103,729	...	482,619	...	...	...
Labuan	1906	2,000	...	...	...	...	...
Philippine Islands	1903	127,559	...	144,171	290	30,428	1,179,371
Russia:							
Central Asia (4 provinces)	1908	1,926,983	...	2,004,328	...	[h]7,532,749	80,016
Siberia (4 provinces)	1908	4,026,822	...	3,138,883	...	[h]4,078,550	864,106
Transcaucasia	1902	2,304,977	...	388,936	...	6,302,258	309,479
Other	1903	2,343,000	...	1,624,000	...	5,443,000	186,400
Total Russia, Asiatic	...	10,601,782	...	7,156,147	...	23,356,557	1,440,001
Siam[i]	1904	1,104,751	...	35,812	...	...	...
Straits Settlements	1907	28,556	...	4,580	...	...	[j]102,000
Turkey, Asiatic	...	3,000,000	...	800,000	...	45,000,000	...
Total Asia	...	112,268,956	...	11,630,302	56,256	90,590,694	4,824,187
AFRICA.							
Algeria	1907	1,081,734	...	221,453	174,182	9,314,515	97,587
Basutoland	1904	213,361	...	64,621	[k]26	[k]2,794	[k]476
British Central Africa	1908	51,649	...	[e]178	...	16,734	19,941
British East Africa	1905	297,000	...	[l]186	...	2,100,000	...
Cape of Good Hope	1907	[m]1,954,390	[m]540,310	[m]255,060	[m]64,433	17,153,013	[m]385,945
Egypt	1900	350,000	...	80,000	10,000	...	...
German East Africa	1905	523,052	...	73	79	1,560,000	1,447
German Southwest Africa	1907	52,189	[c]18,471	2,141	1,234	111,595	1,202
Madagascar[n]	1905	2,867,612	[c]1,118,162	1,074	464	333,454	522,021
Mauritius[o]	1907	11,289	...	692	[p]264	1,014	4,377
Mayotte	(q)	47,894	...	21	15	124	...
Natal	1907	416,527	252,496	39,789	2,206	753,759	45,381
Orange River Colony	1907	585,077	...	127,579	...	8,020,308	62,439
Reunion	(q)	4,720	...	1,780	4,534	4,583	...
St. Helena	1901	1,014	...	120	...	2,094	280
Seychelles	1907	1,000	...	150	...	200	6,000
Sierre Leone	1907	1,873	...	42	...	688	128
Southern Nigeria Colony (Lagos)	1902	1,522	...	108	...	1,610	2,426
Sudan (Anglo-Egyptian)[r]	[g]1905	314,996	...	9,314	...	1,421,721	...
Transvaal	1907	513,468	...	45,136	22,862	2,008,363	111,910
Tunis	1905	183,748	...	35,596	15,995	1,094,761	15,357
Total Africa	...	9,474,115	...	885,113	296,294	43,901,330	1,276,917

[a] Including native States, as far as officially shown. Statistics cover only 8 districts of Bengal, collected between 1889 and 1905.
[b] Including buffalo calves.
[c] Cows.
[d] Of which 373,003 in Alwar include goats.
[e] Including mules and asses.
[f] Not less than 1 year old; 30 per cent may be added for those less than 1 year old.
[g] On Dec. 31 of preceding year.
[h] Including goats.
[i] Census figures for 12 provinces.
[j] Data for 1904.
[k] Excluding animals owned by natives.
[l] Excluding the province of Jubaland.
[m] Census 1904.
[n] Not including animals in the public service.
[o] On sugar estates only.
[p] Including asses; data for 1905.
[q] Official estimate furnished by the French embassy to the United States, under date of May 4, 1906.
[r] Animals assessed for tribute and tax.

Live stock of countries named—Continued.

Country.	Year.	Cattle. Total.	Cattle. Dairy cows.	Horses.	Mules.	Sheep.	Swine.
OCEANIA.							
Australia:							
Queensland	[a]1908	3,892,232	....	488,486	....	16,738,047	133,246
New South Wales	[a]1908	2,749,193	755,916	578,326	....	44,461,839	216,145
Victoria	1907	1,842,807	701,309	424,648	....	14,146,734	211,002
South Australia	1907	688,671	[b] 93,069	226,639	....	6,865,637	91,741
Western Australia	[a]1908	759,046	[c] 27,724	113,117	[d] 1,462	3,694,852	53,122
Tasmania	1907	215,523	....	40,392	....	1,744,800	46,704
Total Australia	......	10,147,472	....	1,871,608	1,462	87,651,909	751,960
British New Guinea	1907	648	....	173	....	....	....
Fiji	1907	30,400	....	[e] 4,857	....	1,000	4,450
New Caledonia	([f])	73,862	....	2,938	12	9,442	2,438
New Zealand [g]	1907	1,816,299	541,363	352,832	[d] 425	20,983,772	241,128
Total Oceania	......	12,068,681	....	2,232,408	1,899	108,646,123	990,976
Grand total	......	428,331,449	....	95,219,388	7,493,840	577,426,584	145,258,805

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
NORTH AMERICA.						
United States:						
Contiguous—						
On farms	1900	94,165	....	....	1,870,599	....
Not on farms	1900	15,847	....	....	78,353	....
Noncontiguous—						
Alaska	1906	....	....	....	....	12,828
Hawaii [h]	1900	1,438	....	....	653	....
Porto Rico	1899	1,085	....	....	15,991	....
Total United States (except Philippine Islands)	......	112,535	....	....	1,965,596	12,828
Central America:						
Costa Rica	1905	100	....	....	906	....
Panama	1907	47	....	....	3,000	....
Mexico	1902	287,991	....	....	4,206,011	....
Newfoundland	1901	....	....	....	17,355	....
West Indies:						
British—Jamaica	1906	....	....	....	15,500	....
Cuba	1908	3,102	....	....	[i] 18,564	....
Dutch	1906	5,540	....	....	57,181	....
Guadeloupe	([f])	4,394	....	....	13,902	....
Total North America	......	413,709	....	....	6,298,015	12,828
SOUTH AMERICA.						
Argentina	1908	285,088	....	....	3,245,086	....
British Guiana	1907	5,750	....	....	13,500	....
Chile	1906	[j] 17,574	....	....	461,908	....
Colombia	......	....	....	....	361,000	....
Dutch Guiana	1906	388	....	....	1,649	....
Paraguay	1900	4,067	....	....	32,334	....
Uruguay	1900	....	....	....	20,428	....
Venezuela	1899	312,810	....	....	1,667,272	....
Total South America	......	625,677	....	....	5,803,177	....

[a] On Dec. 31 of preceding year.
[b] Not including northern territory; data for 1906.
[c] Data for 1905.
[d] Including asses.
[e] Including mules and asses.
[f] Official estimate furnished by the French embassy to the United States, under date of May 4, 1906.
[g] Including animals owned by Maoris.
[h] On farms.
[i] Census for 1899.
[j] Data for 1902.

Live stock of countries named—Continued.

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
EUROPE.						
Austria-Hungary:						
Austria	1900	46,324			1,019,664	
Hungary	1895	23,855	133,000		308,810	
Bosnia-Herzegovina	1895				1,447,049	
Total Austria-Hungary		70,179	133,000		2,775,523	
Belgium	[a]1905				257,669	
Bulgaria	1905	124,216	[b] 431,487		1,370,201	
Denmark	1903				38,984	
Faroe Islands	1903				10	
Finland	1906				5,674	141,572
France	[a]1907	361,073			1,421,009	
Germany	1907	10,349			3,533,970	
Greece	1902	141,179			3,339,409	
Iceland	1906				387	
Italy	1908	848,988	19,362		2,714,513	
Luxemburg	1901				14,203	
Malta	1908	3,764			20,920	
Montenegro					100,000	
Netherlands	1904				165,497	
Norway	1900				214,594	108,784
Portugal		146,500			998,680	
Roumania	1900	7,186	43,475		232,515	
Russia:						
Russia proper	1905			224,500		347,000
Poland				1,000		
Total Russia, European				225,500		347,000
Servia	1905	1,247	7,710		510,063	
Spain	1907	774,443		2,250	2,807,963	
Sweden	1907				65,798	231,627
Switzerland	1906	1,679			362,117	
United Kingdom: Ireland	1907	237,540			247,347	
Total Europe		2,728,343	635,034	227,750	21,197,046	828,983
ASIA.						
British India [c]	1907	[d] 1,340,286	15,134,501	442,301	28,546,674	
Ceylon	1906				177,245	
Cochin China	1903		241,750			
Cyprus	1906			1,169	[e] 250,546	
Hongkong	1905				160	
Japanese Empire:						
Japan	1906				72,750	
Formosa	[a]1905		226,620		117,214	
Total Japanese Empire			226,620		189,964	
Dutch East Indies:						
Java and Madura	1905		2,186,993			
Other	1905		446,540			
Total Dutch East Indies			2,633,533			
Philippine Islands	1903		[f] 640,871		124,334	
Russia:						
Central Asia (4 provinces)	1903			365,000		
Siberia (4 provinces)	1903			500		38,700
Transcaucasia	1902	122,312	338,042	17,122	745,086	
Other	1903	58,500		296,000	802,000	20,000
Total Russia, Asiatic		180,812	338,042	678,622	1,547,086	58,700
Siam [g]	1904		[h] 1,144,478			
Turkey, Asiatic		2,500,000			9,000,000	
Total Asia		4,021,098	20,359,795	1,122,092	39,836,009	58,700

[a] On Dec. 31 of preceding year.
[b] Census data Dec. 31, 1900.
[c] Including native States, as far as officially shown. Statistics cover only 8 districts of Bengal, collected between 1889 and 1905.
[d] Of which 61,025 in Bengal, Alwar, Gwalior, and Marwar includes mules.
[e] Not less than 1 year old; 30 per cent may be added for those less than 1 year old.
[f] Carabaos.
[g] Number of domesticated elephants returned as 2,036.
[h] Census figures for 12 provinces.

Live stock of countries named—Continued.

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
AFRICA.						
Algeria	1907	265,922	....	211,279	4,253,425	....
Basutoland	1904	[a] 10	....	....	1,625	....
British Central Africa	1907	190	8	....	78,511	....
British East Africa	1906	....	....	....	1,150,000	....
Cape of Good Hope	1907	[b] 100,470	....	....	8,699,414	....
Egypt	1900	120,000	300,000	40,000	....	....
German East Africa	1905	8,777	....	24	1,820,000	....
German Southwest Africa	1907	1,630	....	28	103,259	....
Madagascar [c]	1905	411	....	....	66,747	....
Mauritius [d]	1905	....	....	....	7,247	....
Mayotte	([e])	58	....	....	1,508	....
Natal	1906	1,759	....	....	724,428	....
Orange River Colony	1903	3,096	....	....	308,920	....
Reunion	([e])	1,916	....	....	4,156	....
St. Helena	1901	774	....	....	1,001	....
Southern Nigeria Colony (Lagos)	1902	....	....	....	2,600	....
Sudan (Anglo-Egyptian) [f]	1905	[g] 92,272	....	132,116	1,329,711	....
Transvaal	1907	36,057	....	....	1,169,535	....
Tunis	[h]1905	97,990	....	147,229	574,281	....
Total Africa	......	731,332	300,008	530,676	20,296,368	....
OCEANIA.						
Australia:						
New South Wales	[h]1905	....	....	853	37,716	....
South Australia	1905	....	....	....	26,948	....
Western Australia	[h]1908	....	....	3,212	26,833	....
Tasmania	1905	....	....	....	1,694	....
Total Australia	......	....	....	4,065	93,191	....
Fiji	1906	....	....	....	15,945	....
New Caledonia	([e])	....	....	....	6,111	....
New Zealand [i]	1891	....	....	....	9,055	....
Total Oceania	......	....	....	4,065	124,302	....
Grand total	......	8,520,159	21,294,837	1,884,583	93,554,917	900,511

[a] Excluding animals owned by natives.
[b] Census 1904.
[c] Not including animals in the public service.
[d] On sugar estates only.
[e] Official estimate furnished by the French embassy to the United States under date of May 4, 1906.
[f] Animals assessed for tribute and tax.
[g] Including mules.
[h] On Dec. 31 of preceding year.
[i] Including animals owned by Maoris.

International trade in hides and skins.[a]

[Substantially the international trade of the world. This table gives the classification as found in the original returns, and the summary statements for "All countries" represent the total for each class only so far as it is disclosed in the original returns.]

EXPORTS.

Country.	Year beginning—	Kind of hides and skins.	1903.	1904.	1905.	1906.	1907.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	Cattle, dried	51,239,825	50,466,002	53,457,674	51,149,435	45,755,984
		do., salted	63,424,770	64,809,273	90,239,588	72,476,948	74,119,129
		Goat	3,113,899	3,961,693	4,205,350	4,164,487	2,062,001
		Horse, dried	2,870,826	2,152,791	2,801,828	680,007	2,214,675
		do., salted	4,921,984	4,591,961	1,731,726	3,507,399	488,096
		Kid	815,695	1,049,508	971,729	944,222	871,031
		Sheep	92,442,005	81,571,014	66,535,492	52,428,116	53,694,603
Austria-Hungary	Jan. 1	Calf, dried	6,681,327	6,139,211	6,855,933	4,092,440	4,249,850
		do., salted	5,505,382	6,623,787	9,100,680	8,290,261	11,650,104
		Cattle, dried	6,801,038	6,274,354	5,676,240	6,442,126	6,570,214
		do., salted	12,569,873	9,172,109	13,682,766	9,728,115	11,133,562
		Goat	2,004,442	2,542,591	1,977,987	2,542,150	2,346,820
		Horse, dried	1,313,514	1,033,747	2,297,137	1,821,679	777,570
		do., salted	2,162,293	2,495,853	3,808,185	3,490,578	2,417,148
		Kid	1,431,241	2,120,626	1,836,069	1,213,203	830,040
		Lamb	4,232,874	3,187,442	3,535,111	3,538,859	2,358,284
		Sheep	4,034,017	3,575,676	4,251,393	5,061,371	3,887,630
Belgium	Jan. 1	Hides and skins	91,087,316	90,367,454	101,081,934	102,400,208	97,433,761
Brazil	Jan. 1	Deer	265,401	262,167	176,295	195,559	215,636
		Goat	4,193,246	5,556,633	3,361,740	3,842,815	4,997,878
		Hides, dried, not elsewhere specified	16,401,080	23,845,672	17,328,272	21,667,230	15,324,328
		do., salted, not elsewhere specified	46,006,347	48,004,782	42,135,260	50,567,124	54,149,926
		Horse	88,194	245,716	28,936	18,660	1,162
		Lamb	67,298	289,196	5,143	64,218	23,140
		Sheep	598,573	1,042,429	959,755	869,285	1,076,927
		Other	9,262	28,911	33,113	54,227	60,504
British India	Jan. 1	Cattle	73,766,313	78,344,336	94,061,280	126,917,238	89,685,904
		Goat	27,611,430	38,581,900	40,191,648	49,057,568	32,639,040
		Other			14,994,861	9,473,968	4,320,624
Canada[b]	Jan. 1	Sheep pelts	291,000	352,000	242,000	247,000	293,000
		Hides and skins, not elsewhere specified	20,000,000	27,000,000	31,000,000	33,000,000	33,000,000
Cape of Good Hope[c]	Jan. 1	Calf	69,317	90,391	96,562	67,841	47,046
		Cattle	1,189,172	2,049,386	2,970,438	4,566,062	7,423,557
		Goat	5,217,449	4,928,951	5,461,295	5,208,577	6,611,384
		Sheep	12,602,310	11,602,058	11,713,890	14,523,317	17,817,237
		Hides, not elsewhere specified	8,545	637	....	....	....

[a] See "General note," p. 605. [b] Estimated. [c] The figures relate to British South Africa after 1905.

International trade in hides and skins—Continued.

EXPORTS—Continued.

Country.	Year beginning—	Kind of hides and skins.	1903.	1904.	1905.	1906.	1907.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
China	Jan. 1	Hides and skins	32,309,600	37,330,133	51,013,990	56,615,924	165,377,054
Cuba	Jan. 1	Cattle	2,351,012	2,438,844	4,622,643	6,957,223	a 6,957,223
		Other	84,032	52,482	198,299	207,823	a 207,823
Denmark	Jan. 1	Hides and skins	15,520,748	16,166,351	19,345,629	18,442,353	16,509,819
Dutch East Indies	Jan. 1	Hides and skins	13,729,290	13,940,625	14,039,571	15,276,688	15,276,688
Egypt	Jan. 1	Cattle and calf	4,331,513	6,841,357	4,547,315	5,748,384	4,944,008
		Sheep and goat b	697,529	1,084,797	2,620,849	3,196,993	2,322,075
France	Jan. 1	Calf	(c)	21,348,790	17,430,187	23,497,743	d 29,349,251
		Goat	(c)	7,613,556	10,333,419	8,400,492	d 6,067,781
		Kid	1,198,100	875,619	626,944	937,846	d 426,374
		Lamb	1,146,708	1,096,486	1,416,190	1,324,978	d 1,040,582
		Large	48,863,350	53,066,971	61,880,962	69,136,285	d 71,435,485
		Sheep	8,517,409	9,047,394	10,003,113	11,967,350	d 14,951,305
		Other	27,052,872	3,035,932	7,776,412	6,723,877	d 2,430,855
Germany e	Jan. 1	Calf, green	9,076,870	8,618,308	10,235,619	16,865,579	17,197,595
		do., dried	7,410,396	9,228,989	9,504,125		
		Cattle, green	65,404,300	65,279,298	65,859,114	80,434,531	77,366,579
		do., dried	9,406,240	9,416,161	11,561,258		
		Goat, with hair on	3,350,364	4,021,451	3,744,110	3,198,907	1,949,106
		do., without hair	12,566	15,432	19,101		
		Horse, green	10,715,124	8,345,156	16,119,958	18,055,854	11,701,472
		do., dried	1,711,448	1,782,878	1,629,216		
		Sheep	811,521	385,147	823,206	4,766,834	5,472,754
		Other	607,814	698,865	604,507	605,830	563,722
Italy	Jan. 1	Cattle and calf	24,070,283	23,639,941	19,357,463	25,858,232	d 24,820,296
		Sheep and goat	4,329,437	4,125,950	4,616,038	4,502,500	d 3,541,725
		Other	765,665	695,338	2,737,700	910,729	d 1,609,595
Korea	Jan. 1	Cattle	5,525,600	4,755,600	2,273,200	2,209,733	2,423,600
		Skins	5,421,200	4,660,533	5,507,867	6,170,533	7,619,467
Mexico	Jan. 1	Alligator	278,666	229.777	134,952	179,081	190,627
		Cattle	13,571,064	11,841,898	14,392,088	18,087,442	17,930,676
		Deer	665,538	619,358	572,190	730,660	802,260
		Goat	6,457,031	5,711,186	6,356,232	7,634,630	6,649,277
		Sheep	3,243	1,777	935	17,428	46,698
Netherlands	Jan. 1	Hides, dried	20,607,052	23,647,466	22,724,931	24,050,349	19,844,098
		do., fresh	414,482	301,548	236,435	237,965	165,450
		do., salted	33,893,118	31,865,968	32,383,298	34,507,035	32,386,777
		Sheep	2,309,591	2,708,125	1,664,492	1,322,985	1,820,636

New Zealand	Jan. 1	Calf *f*	23,136	29,862	103,286	276,056	439,425
		Hides *f*	1,013,593	1,041,637	1,926,182	2,554,873	3,470,939
		Sheep	15,074,406	12,833,612	12,599,222	14,364,574	16,158,919
Peru	Jan. 1	Hides and skins	6,009,920	6,717,760	6,954,866	7,941,310	*a* 7,941,310
Russia	Jan. 1	Hides, large	12,774,759	16,666,202	14,284,165	31,578,585	*d* 14,734,022
		do., small	19,949,009	24,406,908	24,540,778	26,235,263	*d* 24,484,478
		Sheep and goats	17,884,900	22,220,675	19,206,232	35,616,899	*d* 26,867,923
Singapore	Jan. 1	Hides	8,694,100	6,919,733	7,268,133	7,510,800	*a* 7,510,800
Spain	Jan. 1	Goat	2,628,269	2,014,515	1,748,702	1,017,973	*d* 1,733,772
		Sheep	5,210,152	6,305,843	8,383,804	8,042,360	*d* 5,435,165
		Other	4,248,659	5,965,021	9,359,902	12,536,488	*d* 7,594,616
Sweden	Jan. 1	Hides and skins	13,025,318	12,647,729	15,709,468	16,247,694	13,230,261
Switzerland	Jan. 1	Hides	12,201,260	11,750,194	12,095,438	13,414,023	14,900,599
		Skins	5,041,530	5,544,404	6,062,490	5,744,584	6,713,735
United Kingdom	Jan. 1	Hides	17,451,168	21,128,464	29,427,328	31,359,776	21,690,144
		Skins *b*	44,795,115	49,864,593	46,964,937	37,835,419	35,403,011
United States	Jan. 1	Hides and skins	21,251,307	24,514,226	8,654,522	16,025,299	11,126,157
Uruguay	July 1	Calf	2,967,990	2,074,655	1,795,344	3,243,609	3,243,609
		Cattle, dried	15,019,462	13,852,273	14,056,903	15,997,943	15,997,943
		do., salted *b*	35,823,136	41,159,472	30,875,494	24,357,872	24,357,872
		Goat	1,411	9,539	34	4,588	*a* 4,588
		Horse, dried *b*	397,568	1,607,872	515,104	430,896	*a* 430,896
		do., salted *b*	1,751,352	504,196	124,608	60,544	*a* 60,544
		Lamb	608,383	406,598	346,719	294,330	*a* 294,330
		Sheep	19,397,852	16,033,901	14,990,823	13,795,738	*a* 13,795,738
Venezuela	July 1	Cattle	8,366,624	7,624,535	7,929,730	6,399,486	*a* 6,399,486
		Deer	....	....	349,459	349,459	*a* 349,459
		Goat	1,650,675	1,446,752	1,479,815	1,402,444	*a* 1,402,444
Other countries	....	Hides:					
		Cattle	17,486,222	12,706,880	46,832,873	36,232,222	*d* 32,947,250
		Horse	80,026	348,784	471,232	507,364	*d* 749,842
		Large, not otherwise classified	3,148,588	6,198,614	303,172	....	....
		Small, not otherwise classified	1,352,037	1,915,667	....	....	....
		Unclassified	14,085,945	8,906,979	14,384,816	1,867	*d* 30,408
		Skins:					
		Calf	1,799,084	2,183,255	2,435,640	2,443,922	*d* 3,719,809
		Deer	1,303,750	1,372,926	859,467	17,761,809	*d* 18,182,340
		Goat	6,536,130	4,427,066	8,010,735	6,324,174	*d* 5,135,615
		Kid	21,786	40,836	1,040,412	580,236	*d* 28,440
		Sheep	3,313,301	2,942,913	11,014,904	10,441,862	*d* 12,836,005
		Sheep and goat, mixed	6,048,093	8,084,693	19,280,233	3,551,489	*d* 3,551,489
		Unclassified	73,145	66,311	5,805,481	1,275,344	*d* 1,511,328
		Hides and skins, unclassified	6,441,858	5,393,110	8,597,283	46,160,034	*d* 12,932,766
Total	....	....	1,302,609,707	1,350,774,979	1,494,607,504	1,593,012,297	1,569,353,398

a Year preceding.
b Number of pounds computed from stated number of hides or skins.
c Not separately stated.
d Preliminary.
e Not including free ports prior to Mar. 1, 1906.
f Estimated.

International trade in hides and skins—Continued.

EXPORTS—Continued.

Country.	Year beginning—	Kind of hides and skins.	1903.	1904.	1905.	1906.	1907.
RECAPITULATION.							
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
All countries		Hides:					
		Cattle	381,944,951	380,190,421	458,491,289	461,956,376	419,068,979
		Cattle and calf, mixed	28,401,796	30,481,298	23,904,778	31,606,616	29,764,304
		Horse	26,015,572	23,110,731	29,559,465	28,572,981	18,841,405
		Large, not otherwise classified	64,786,697	75,931,787	76,468,299	100,714,870	86,169,507
		Small, not otherwise classified	21,301,037	26,322,575	24,540,778	26,235,263	24,484,478
		Unclassified	170,776,990	177,413,080	179,910,093	185,871,042	169,473,469
		Skins:					
		Alligator	278,666	229,777	134,952	179,081	190,627
		Calf	33,533,502	56,337,248	57,557,376	58,777,451	69,896,689
		Deer	2,234,689	2,254,451	1,957,411	19,037,487	19,519,695
		Goat	35,165,485	42,219,365	86,890,798	92,798,805	71,599,706
		Kid	3,466,822	4,086,619	4,475,094	3,675,507	2,155,885
		Lamb	6,055,263	4,979,722	5,333,163	5,222,385	3,716,336
		Sheep	164,602,137	148,100,112	143,187,824	137,848,220	147,286,947
		Sheep and goat, mixed	28,959,959	35,516,115	45,723,352	46,867,881	36,283,212
		Unclassified	55,331,020	60,135,841	64,340,775	51,080,107	51,308,078
		Hides and skins, unclassified	279,755,121	283,135,837	292,132,057	342,568,225	419,564,081
Total			1,302,609,707	1,350,774,979	1,494,607,504	1,593,012,297	1,569,353,398

IMPORTS.

Country.	Year beginning—	Kind of hides and skins.	1903.	1904.	1905.	1906.	1907.
Austria-Hungary	Jan. 1	Calf, dried	1,245,171	1,496,718	1,056,896	1,641,782	1,608,492
		do., green	1,716,078	1,449,759	994,505	1,795,444	1,864,449
		Cattle, dried	22,300,192	29,398,855	25,180,311	43,766,156	36,294,251
		do., green	18,503,392	27,347,451	17,540,414	31,964,594	27,210,106
		Goat	1,100,547	1,588,130	1,410,076	1,279,563	1,243,407
		Horse, dried	583,784	560,856	360,676	494,496	59,304
		do., green	125,223	153,662	224,871	500,670	630,301
		Kid	844,591	1,046,693	723,557	638,899	570,997
		Lamb	9,627,600	10,328,434	8,602,435	10,561,242	7,591,616
		Sheep	5,391,403	5,041,309	5,061,592	6,890,767	4,843,334
Belgium	Jan. 1	Hides, raw	128,694,622	122,539,211	135,911,437	142,197,407	137,852,633
British India	Jan. 1	Hides	9,850,090	11,738,210	9,433,956	9,522,643	10,799,319
		Skins	5,331,781	4,830,536	4,444,104	5,274,370	4,664,990
Denmark	Jan. 1	Hides and skins	5,766,189	6,962,196	7,848,454	10,294,482	9,504,125
Finland	Jan. 1	Hides, dried	1,560,180	1,869,515	1,898,433	2,631,124	2,698,193
		do., green	5,907,507	5,780,115	4,263,421	5,529,891	636,550
		Sheep	45,380	89,521	56,061	68,050	a 68,050

France	Jan. 1	Calf	(b)	7,090,953	7,980,756	9,035,423	c6,591,820
		Goat	(b)	17,899,172	23,110,243	23,276,399	c19,777,223
		Kid	4,714,701	4,372,843	4,544,123	4,935,708	c3,798,564
		Lamb	441,758	370,533	378,553	374,565	c251,547
		Large	89,049,162	85,214,688	98,515,340	106,831,132	c97,556,948
		Sheep	3,032,612	2,630,226	2,532,200	3,201,332	c3,159,664
		Other	28,990,427	2,063,720	3,209,189	1,674,851	c1,433,666
Germany [d]	Jan. 1	Calf, dried	18,793,521	21,104,405	22,145,869	18,811,819	14,672,421
		do., green	22,039,386	24,738,945	32,244,140	38,531,942	39,555,328
		Cattle, dried	60,664,363	63,954,541	70,228,234	77,797,583	74,161,500
		do., green	146,242,719	152,057,850	143,851,586	177,694,958	161,336,884
		Goat, with hair on	9,266,908	11,272,453	11,042,952	14,543,450	11,691,330
		do., without hair	25,794	61,068	38,140		
		Horse, dried	4,427,101	4,666,964	4,592,889	6,688,823	5,081,433
		do., green	30,128,805	27,629,866	25,891,742	30,573,918	21,788,279
		Sheep	737,005	1,126,562	746,485	1,345,040	1,116,861
		Other	3,032,017	3,515,711	3,340,443	2,157,002	1,864,008
Greece	Jan. 1	Hides	5,674,975	7,004,659	6,055,809	5,286,300	5,609,972
Italy	Jan. 1	Cattle and calf	32,555,653	42,876,591	39,240,949	44,294,383	c40,321,214
		Sheep and goat	9,197,903	9,997,520	8,740,884	11,596,532	c9,116,333
		Other	136,687	89,287	181,881	277,782	c168,433
Japan	Jan. 1	Cattle	4,516,054	9,871,720	7,402,046	5,450,564	8,365,319
		Deer	437,982	373,908	426,217	700,708	751,884
Netherlands	Jan. 1	Hides, dried	28,746,002	28,190,550	29,700,509	30,643,584	29,418,436
		do., fresh	3,486	1,080	15,141	5,404	9,090
		do., salted	24,734,682	25,207,165	21,586,003	27,913,694	20,705,512
		Sheep	1,631,356	2,084,239	2,367,808	2,094,329	3,226,381
Norway	Jan. 1	Hides and skins	5,555,934	6,890,458	8,722,279	10,507,625	10,191,328
Portugal	Jan. 1	Hides, dried	6,188,733	5,829,003	4,216,487	5,227,560	a5,227,560
		do., green	507,616	243,906	181,630	152,868	a152,868
		do., not elsewhere specified	990	825	414	15,249	a15,249
Roumania	Jan. 1	Buffalo	160,214	39,361	83,987		
		Calf	65,731	13,406	13,728	33,363	a33,363
		Cattle	3,468,799	2,444,346	2,252,952	7,512,516	a7,512,516
		Horse	8,014	22	3,490		
		Sheep, lamb, and goat	610,125	400,000	157,536	700,517	a700,517
		Other	158,376	163,773	132,822	65,949	a65,949
Russia	Jan. 1	Hides, dry	12,279,363	10,412,368	12,668,515	10,147,336	c7,511,462
		do., green	55,754,913	48,126,842	51,753,326	45,639,682	c59,513,894
		Goat and kid				1,694,232	c216,676
Singapore	Jan. 1	Hides	10,258,000	10,554,133	8,191,200	9,236,000	a9,236,000
Spain	Jan. 1	Hides and skins	22,716,150	17,857,559	14,247,484	17,281,585	c16,591,299
Sweden	Jan. 1	Hides and skins	15,172,306	19,782,796	18,939,762	21,290,081	20,360,262
United Kingdom	Jan. 1	Goat [e]	3,557,151	5,517,464	3,756,596	9,329,915	7,931,127
		Hides	62,491,856	61,636,848	60,628,848	70,661,696	70,407,222
		Sheep [e]	44,909,414	34,490,368	34,694,106	42,124,265	f6,674,839
		Other	3,124,408	1,386,550	377,900	1,135,080	568,416

[a] Year preceding.
[b] Not separately stated.
[c] Preliminary.
[d] Not including free ports prior to March 1, 1906.
[e] Number of pounds computed from stated number of hides and skins.
[f] Pickled sheep skins only. Sheep skins with wool left on were stated in weight for 1907 and not included.

International trade in hides and skins—Continued.

IMPORTS—Continued.

Country.	Year beginning—	Kind of hides and skins.	1903.	1904.	1905.	1906.	1907.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
United States	Jan. 1	Cattle	106,313,926	91,686,817	136,612,360	144,040,983	122,932,034
		Goat	82,039,248	95,447,448	102,940,811	109,232,719	86,252,338
		Other	100,634,669	113,690,977	141,587,241	145,253,161	146,363,578
Other countries		Hides:					
		Cattle	5,441,221	7,289,141	7,143,387	8,324,330	[a]8,903,483
		Horse	...	...	...	5,543	[a]7,703
		Large, not otherwise classified	438,604	1,054,916	328,180	...	...
		Small, not otherwise classified	7,011	17,289	} 9,368,570	...	...
		Unclassified	8,100,685	4,932,465		3,665,524	[a]2,624,797
		Skins:					
		Calf	13,933	153,261	128,604	131,676	[a]133,340
		Deer	9,886	21,014	...	...	...
		Goat	423,808	452,838	665,581	601,551	[a]450,976
		Kid	...	...	...	23,316	[a]9,647
		Sheep	1,533,850	1,534,647	741,964	1,199,522	[a]1,150,769
		Sheep and goat, mixed	22,447	10,416	3,849	57,770	[a]400
		Unclassified	1,348,347	1,277,800	2,003,073	1,806,172	[a]1,483,80[illegible]
		Hides and skins, unclassified	3,097,490	1,179,409	898,578	7,708,879	[a]9,017,453
Total			1,304,227,907	1,332,226,559	1,418,566,590	1,595,595,470	1,437,644,045
RECAPITULATION.							
All countries		Hides:					
		Buffalo	160,214	39,361	83,987	...	...
		Cattle	367,450,666	381,050,724	410,211,290	496,551,684	446,716,093
		Cattle and calf, mixed	32,555,653	22,876,591	39,240,949	44,294,383	40,321,214
		Horse	35,272,927	33,011,370	31,073,668	38,263,450	27,567,020
		Large, not otherwise classified	89,487,666	86,269,604	98,843,520	106,831,132	97,556,948
		Small, not otherwise classified	7,011	17,289	} 355,873,699	368,475,962	368,151,767
		Unclassified	360,753,700	314,066,895			
		Skins:					
		Calf	43,873,820	56,047,447	64,564,498	69,981,449	64,459,213
		Deer	447,868	394,922	426,217	700,708	751,884
		Goat	96,413,456	132,238,873	142,964,399	159,901,529	127,454,739
		Kid	5,559,292	5,418,936	5,267,680	5,654,223	4,487,546
		Lamb	10,069,358	10,698,967	8,980,988	10,935,807	7,843,163
		Sheep	57,281,020	46,996,872	46,200,216	56,923,305	20,239,898
		Sheep and goat, mixed	9,830,475	10,407,936	8,902,269	12,354,819	9,817,250
		Unclassified	6,680,128	6,108,336	6,447,177	7,080,512	6,148,793
		Hides and skins, unclassified	188,384,653	173,582,136	199,486,033	217,646,477	216,128,517
Total			1,304,227,907	1,332,226,559	1,418,566,590	1,595,595,470	1,437,644,045

[a] Preliminary.

FARM ANIMALS AND THEIR PRODUCTS IN CONTINENTAL UNITED STATES.

HORSES AND MULES.

Number and farm value of horses and mules on farms in the United States, 1867–1909.

January 1—	Horses.			Mules.		
	Number.	Price per head Jan. 1.	Farm value Jan. 1.	Number.	Price per head Jan. 1.	Farm value Jan. 1.
1867	5,401,263	$59.05	$318,924,085	822,386	$66.94	$55,048,257
1868	5,756,940	54.27	312,416,048	855,685	56.04	47,953,624
1869	6,332,793	62.57	396,222,359	921,662	79.23	73,026,906
1870	8,248,800	67.49	556,250,529	1,179,500	90.42	106,654,015
1871	8,702,000	71.14	619,038,564	1,242,300	91.98	114,272,194
1872	8,990,900	67.41	606,111,449	1,276,300	87.14	111,221,919
1873	9,222,470	66.39	612,273,159	1,310,000	85.15	111,546,171
1874	9,333,800	65.15	608,072,797	1,339,350	81.35	108,952,659
1875	9,504,200	61.10	580,707,854	1,393,750	71.89	100,197,044
1876	9,735,300	57.29	557,746,731	1,414,500	66.46	94,000,976
1877	10,155,400	55.83	567,016,871	1,443,500	64.07	92,481,931
1878	10,329,700	56.63	584,998,503	1,637,500	62.03	101,579,278
1879	10,938,700	52.36	572,712,085	1,713,100	56.00	95,941,589
1880	11,201,800	54.75	613,296,611	1,729,500	61.26	105,948,319
1881	11,429,626	58.44	667,954,325	1,720,731	69.79	120,096,164
1882	10,521,554	58.53	615,824,914	1,835,169	71.35	130,945,378
1883	10,838,111	70.59	765,041,308	1,871,079	79.49	148,732,390
1884	11,169,683	74.64	833,734,400	1,914,126	84.22	161,214,976
1885	11,564,572	73.70	852,282,947	1,972,569	82.38	162,497,097
1886	12,077,657	71.27	860,823,208	2,052,593	79.60	163,381,096
1887	12,496,744	72.15	901,685,755	2,117,141	78.91	167,057,538
1888	13,172,936	71.82	946,096,154	2,191,727	79.78	174,853,563
1889	13,663,294	71.89	982,194,827	2,257,574	79.49	179,444,481
1890	14,213,837	68.84	978,516,562	2,331,027	78.25	182,394,099
1891	14,056,750	67.00	941,823,222	2,296,532	77.88	178,847,370
1892	15,498,140	65.01	1,007,593,636	2,314,699	75.55	174,882,070
1893	16,206,802	61.22	992,225,185	2,331,128	70.68	164,763,751
1894	16,081,139	47.83	769,224,799	2,352,231	62.17	146,232,811
1895	15,893,318	36.29	576,730,580	2,333,108	47.55	110,927,834
1896	15,124,057	33.07	500,140,186	2,278,946	45.29	103,204,457
1897	14,364,667	31.51	452,649,396	2,215,654	41.66	92,302,090
1898	13,960,911	34.26	478,362,407	2,190,282	43.88	96,109,516
1899	13,665,307	37.40	511,074,813	2,134,213	44.96	95,963,261
1900	13,537,524	44.61	603,969,442	2,086,027	53.55	111,717,092
1901	16,744,723	52.86	885,200,168	2,864,458	63.97	183,232,209
1902	16,531,224	58.61	968,935,178	2,757,017	67.61	186,411,704
1903	16,557,373	62.25	1,030,705,959	2,728,088	72.49	197,753,327
1904	16,736,059	67.93	1,136,940,298	2,757,916	78.88	217,532,832
1905	17,057,702	70.37	1,200,310,020	2,888,710	87.18	251,840,378
1906	18,718,578	80.72	1,510,889,906	3,404,361	98.31	334,680,520
1907	19,746,583	93.51	1,846,578,412	3,816,692	112.16	428,063,613
1908	19,992,000	93.41	1,867,530,000	3,869,000	107.76	416,939,000
1909	20,640,000	95.64	1,974,052,000	4,053,000	107.84	437,082,000

Number, average price, and farm value of horses and mules on farms in the United States January 1, 1909.

State, Territory, or Division.	Horses.			Mules.		
	Number.	Average price per head Jan. 1.	Farm value Jan. 1.	Number.	Average price per head Jan. 1.	Farm value Jan. 1.
Maine	117,000	$107.00	$12,519,000			
New Hampshire	59,000	98.00	5,782,000			
Vermont	93,000	103.00	9,579,000			
Massachusetts	83,000	116.00	9,628,000			
Rhode Island	14,000	126.00	1,764,000			
Connecticut	61,000	123.00	7,503,000			
New York	710,000	114.00	80,940,000	4,000	$127.00	$508,000
New Jersey	102,000	124.00	12,648,000	5,000	137.00	685,000
Pennsylvania	619,000	116.00	71,804,000	43,000	128.00	5,504,000
Delaware	37,000	100.00	3,700,000	6,000	129.00	774,000
Maryland	158,000	100.00	15,800,000	20,000	126.00	2,520,000
Virginia	314,000	100.00	31,400,000	53,000	116.00	6,148,000
West Virginia	195,000	102.00	19,890,000	12,000	107.00	1,284,000
North Carolina	192,000	110.00	21,120,000	179,000	127.00	22,733,000
South Carolina	85,000	121.00	10,285,000	141,000	140.00	19,740,000
Georgia	140,000	116.00	16,240,000	241,000	134.00	32,294,000
Florida	54,000	104.00	5,616,000	20,000	142.00	2,840,000
Ohio	958,000	113.00	108,254,000	21,000	111.00	2,331,000
Indiana	830,000	107.00	88,810,000	92,000	112.00	10,304,000
Illinois	1,623,000	109.00	176,907,000	149,000	113.00	16,837,000
Michigan	739,000	110.00	81,290,000	4,000	111.00	444,000
Wisconsin	662,000	107.00	70,834,000	5,000	103.00	515,000
Minnesota	752,000	100.00	75,200,000	9,000	104.00	936,000
Iowa	1,419,000	103.00	146,157,000	46,000	112.00	5,152,000
Missouri	995,000	90.00	89,550,000	337,000	103.00	34,711,000
North Dakota	678,000	101.00	68,478,000	8,000	112.00	896,000
South Dakota	594,000	93.00	55,242,000	9,000	103.00	927,000
Nebraska	1,035,000	91.00	94,185,000	71,000	104.00	7,384,000
Kansas	1,152,000	89.00	102,528,000	147,000	105.00	15,435,000
Kentucky	399,000	95.00	37,905,000	207,000	106.00	21,942,000
Tennessee	324,000	103.00	33,372,000	287,000	111.00	31,857,000
Alabama	168,000	88.00	14,784,000	248,000	108.00	26,784,000
Mississippi	265,000	78.00	20,670,000	287,000	107.00	30,709,000
Louisiana	233,000	65.00	15,145,000	176,000	102.00	17,952,000
Texas	1,342,000	71.00	95,282,000	688,000	93.00	63,984,000
Oklahoma	781,000	73.00	57,013,000	185,000	96.00	17,760,000
Arkansas	293,000	72.00	21,096,000	217,000	99.00	21,483,000
Montana	304,000	65.00	19,760,000	5,000	83.00	415,000
Wyoming	135,000	65.00	8,775,000	1,000	89.00	89,000
Colorado	275,000	72.00	19,800,000	12,000	95.00	1,140,000
New Mexico	130,000	41.00	5,330,000	8,000	71.00	568,000
Arizona	111,000	53.00	5,883,000	5,000	93.00	465,000
Utah	125,000	72.00	9,000,000	3,000	75.00	225,000
Nevada	96,000	70.00	6,720,000	4,000	90.00	360,000
Idaho	158,000	82.00	12,956,000	2,000	101.00	202,000
Washington	320,000	101.00	32,320,000	5,000	108.00	540,000
Oregon	299,000	92.00	27,508,000	8,000	103.00	824,000
California	412,000	90.00	37,080,000	83,000	107.00	8,881,000
United States	20,640,000	95.64	1,974,052,000	4,053,000	107.84	437,082,000
Division: [a]						
North Atlantic	1,858,000	114.19	212,167,000	52,000	128.79	6,697,000
South Atlantic	1,175,000	105.58	124,051,000	672,000	131.45	88,333,000
N. Central E. Miss. R.	4,812,000	109.33	526,095,000	271,000	112.29	30,431,000
N. Central W. Miss. R.	6,625,000	95.30	631,340,000	627,000	104.37	65,441,000
South Central	3,805,000	77.60	295,267,000	2,295,000	101.29	232,471,000
Far Western	2,365,000	78.28	185,132,000	136,000	100.80	13,709,000

[a] See note *a*, page 599.

Imports and exports of horses and mules, with average prices, 1892–1908.

Year ending June 30—	Imports of horses.			Exports of horses.			Exports of mules.		
	Number.	Value.	Average import price.	Number.	Value.	Average export price.	Number.	Value.	Average export price.
1892	14,074	$2,455,868	$174.50	3,226	$611,188	$189.46	1,965	$238,591	$121.42
1893	15,451	2,388,267	154.57	2,967	718,607	242.20	1,634	210,278	128.69
1894	6,166	1,319,572	214.01	5,246	1,108,995	211.40	2,063	240,961	116.80
1895	13,098	1,055,191	80.56	13,984	2,209,298	157.99	2,515	186,452	74.14
1896	9,991	662,591	66.32	25,126	3,530,703	140.52	5,918	406,161	68.63
1897	6,998	464,808	66.42	39,532	4,769,265	120.64	7,473	545,331	72.97
1898	3,085	414,899	134.49	51,150	6,176,569	120.75	8,098	664,789	82.09
1899	3,042	551,050	181.15	45,778	5,444,342	118.93	6,755	516,908	76.52
1900	3,102	596,592	192.32	64,722	7,612,616	117.62	43,369	3,919,478	90.38
1901	3,785	985,738	260.43	82,250	8,873,845	107.89	34,405	3,210,267	93.31
1902	4,832	1,577,234	326.41	103,020	10,048,046	97.53	27,586	2,692,298	97.60
1903	4,999	1,536,296	307.32	34,007	3,152,159	92.69	4,294	521,725	121.47
1904	4,726	1,460,287	308.99	42,001	3,189,100	75.93	3,658	412,971	112.90
1905	5,180	1,591,083	307.16	34,822	3,175,259	91.19	5,826	645,464	110.79
1906	6,021	1,716,675	285.11	40,087	4,365,981	108.91	7,167	989,639	138.08
1907	6,080	1,978,105	325.35	32,882	4,359,957	131.99	6,781	850,901	125.48
1908	5,487	1,604,392	292.40	19,000	2,612,587	137.50	6,609	990,667	149.90

CATTLE.

Imports and exports of live cattle, with average prices, 1892–1908.

Year ending June 30—	Imports.			Exports.		
	Number.	Value.	Average import price.	Number.	Value.	Average export price.
1892	2,168	$47,466	$21.89	394,607	$35,099,095	$88.95
1893	3,293	45,682	13.87	287,094	26,032,428	90.68
1894	1,592	18,704	11.75	359,278	33,461,922	93.14
1895	149,781	765,853	5.11	331,722	30,603,796	92.26
1896	217,826	1,509,856	6.93	372,461	34,560,672	92.79
1897	328,977	2,589,857	7.87	392,190	36,357,451	92.70
1898	291,589	2,913,223	9.99	439,255	37,827,500	86.12
1899	199,752	2,320,362	11.62	389,490	30,516,833	78.35
1900	181,006	2,257,694	12.47	397,286	30,635,153	77.11
1901	146,022	1,931,433	13.23	459,218	37,566,980	81.81
1902	96,027	1,608,722	16.75	392,884	29,902,212	76.11
1903	66,175	1,161,548	17.55	402,178	29,848,936	74.22
1904	16,056	310,737	19.35	593,409	42,256,291	71.21
1905	27,855	458,572	16.46	567,806	40,598,048	71.50
1906	29,019	548,430	18.90	584,239	42,081,170	72.03
1907	32,402	565,122	17.44	423,051	34,577,392	81.73
1908	92,356	1,507,310	16.32	349,210	29,339,134	84.02

Number and value of milch cows and other cattle on farms in the United States, 1867–1909.

January 1—	Milch cows.			Other cattle.		
	Number.	Price per head Jan. 1.	Farm value Jan. 1.	Number.	Price per head Jan. 1.	Farm value Jan. 1.
1867	8,348,773	$28.74	$239,946,612	11,730,952	$15.79	$185,253,850
1868	8,691,568	26.56	230,816,717	11,942,484	15.06	179,887,797
1869	9,247,714	29.15	269,610,021	12,185,385	18.73	228,183,001
1870	10,095,600	32.70	330,175,234	15,388,500	18.87	290,400,588
1871	10,023,000	33.89	339,700,528	16,212,200	20.78	336,859,617
1872	10,303,500	29.45	303,438,398	16,389,800	18.12	296,931,664
1873	10,575,900	26.72	282,559,051	16,413,800	18.06	296,448,036
1874	10,705,300	25.63	274,325,680	16,218,100	17.55	284,705,983
1875	10,906,800	25.74	280,700,645	16,313,400	16.91	275,871,664
1876	11,085,400	25.61	283,878,869	16,785,300	17.00	285,387,123
1877	11,260,800	25.47	286,778,030	17,956,100	15.99	287,155,528
1878	11,300,100	25.74	290,897,809	19,223,300	16.72	321,345,691
1879	11,826,400	21.71	256,720,779	21,408,100	15.38	329,253,631
1880	12,027,000	23.27	279,899,420	21,231,000	16.10	341,761,154
1881	12,368,653	23.95	296,277,060	20,938,710	17.33	362,861,509
1882	12,611,632	25.89	326,489,310	23,280,238	19.89	463,069,501
1883	13,125,685	30.21	396,575,405	28,046,077	21.81	611,549,109
1884	13,501,206	31.37	423,486,649	29,046,101	23.52	683,229,054
1885	13,904,722	29.70	412,903,093	29,866,573	23.25	694,382,913
1886	14,235,388	27.40	389,985,523	31,275,242	21.17	661,956,274
1887	14,522,083	26.08	378,789,589	33,511,750	19.79	663,137,926
1888	14,856,414	24.65	366,252,173	34,378,363	17.79	611,750,520
1889	15,298,625	23.94	366,226,376	35,032,417	17.05	597,236,812
1890	15,952,883	22.14	353,152,133	36,849,024	15.21	560,625,137
1891	16,019,591	21.62	346,397,900	36,875,648	14.76	544,127,908
1892	16,416,351	21.40	351,378,132	37,651,239	15.16	570,749,155
1893	16,424,087	21.75	357,299,785	35,954,196	15.24	547,882,204
1894	16,487,400	21.77	358,998,661	36,608,168	14.66	536,789,747
1895	16,504,629	21.97	362,601,729	34,364,216	14.06	482,999,129
1896	16,137,586	22.55	363,955,545	32,085,409	15.86	508,928,416
1897	15,941,727	23.16	369,239,993	30,508,408	16.65	507,929,421
1898	15,840,886	27.45	434,813,826	29,264,197	20.92	612,296,634
1899	15,990,115	29.66	474,233,925	27,994,225	22.79	637,931,135
1900	16,292,360	31.60	514,812,106	27,610,054	24.97	689,486,260
1901	16,833,657	30.00	505,093,077	45,500,213	19.93	906,644,003
1902	16,696,802	29.23	488,130,324	44,727,797	18.76	839,126,073
1903	17,105,227	30.21	516,711,914	44,659,206	18.45	824,054,902
1904	17,419,817	29.21	508,841,489	43,629,498	16.32	712,178,134
1905	17,572,464	27.44	482,272,203	43,669,443	15.15	661,571,308
1906	19,793,866	29.44	582,788,592	47,067,656	15.85	746,171,709
1907	20,968,265	31.00	645,496,980	51,565,731	17.10	881,557,398
1908	21,194,000	30.67	650,057,000	50,073,000	16.89	845,938,000
1909	21,720,000	32.36	702,945,000	49,379,000	17.49	863,754,000

Number, average price, and farm value of cattle on farms in the United States January 1, 1909.

State, Territory, or Division.	Milch cows.			Other cattle.		
	Number.	Average price per head Jan. 1.	Farm value Jan. 1.	Number.	Average price per head Jan. 1.	Farm value Jan. 1.
Maine	179,000	$29.00	$5,191,000	145,000	$15.00	$2,175,000
New Hampshire	124,000	32.00	3,968,000	97,000	18.00	1,746,000
Vermont	288,000	30.00	8,640,000	214,000	13.50	2,889,000
Massachusetts	194,000	40.00	7,760,000	90,000	16.00	1,440,000
Rhode Island	26,000	43.00	1,118,000	10,000	18.00	180,000
Connecticut	137,000	38.00	5,206,000	83,000	17.50	1,452,000
New York	1,789,000	34.25	61,273,000	898,000	16.50	14,817,000
New Jersey	190,000	45.50	8,645,000	82,000	20.50	1,681,000
Pennsylvania	1,152,000	37.00	42,624,000	965,000	18.50	17,852,000
Delaware	38,000	36.00	1,368,000	22,000	19.50	429,000
Maryland	158,000	33.00	5,214,000	141,000	20.00	2,820,000
Virginia	294,000	28.75	8,452,000	578,000	18.50	10,693,000
West Virginia	247,000	32.50	8,028,000	538,000	21.50	11,567,000
North Carolina	294,000	25.00	7,350,000	454,000	11.50	5,221,000
South Carolina	139,000	27.00	3,753,000	225,000	11.50	2,588,000
Georgia	311,000	23.50	7,308,000	680,000	9.50	6,460,000
Florida	93,000	26.50	2,464,000	691,000	10.00	6,910,000
Ohio	947,000	37.75	35,749,000	998,000	22.00	21,956,000
Indiana	680,000	35.50	24,140,000	1,052,000	21.50	22,618,000
Illinois	1,220,000	37.00	45,140,000	2,056,000	23.00	47,288,000
Michigan	891,000	35.25	31,408,000	993,000	16.00	15,888,000
Wisconsin	1,462,000	34.00	49,708,000	1,114,000	15.00	16,710,000
Minnesota	1,092,000	30.25	33,033,000	1,253,000	12.50	15,662,000
Iowa	1,586,000	34.00	53,924,000	3,842,000	22.50	86,445,000
Missouri	984,000	31.00	30,504,000	2,232,000	21.00	46,872,000
North Dakota	235,000	30.50	7,168,000	642,000	17.50	11,235,000
South Dakota	643,000	30.00	19,290,000	1,397,000	18.50	25,844,000
Nebraska	897,000	31.00	27,807,000	3,200,000	20.00	64,000,000
Kansas	744,000	33.00	24,552,000	3,505,000	21.50	75,358,000
Kentucky	402,000	30.75	12,362,000	700,000	18.50	12,950,000
Tennessee	334,000	24.00	8,016,000	595,000	12.00	7,140,000
Alabama	289,000	22.00	6,358,000	544,000	8.00	4,352,000
Mississippi	330,000	20.00	6,600,000	595,000	8.00	4,760,000
Louisiana	196,000	23.50	4,606,000	480,000	10.00	4,800,000
Texas	1,126,000	27.00	30,402,000	7,668,000	13.00	99,684,000
Oklahoma	338,000	26.25	8,872,000	1,760,000	16.50	29,040,000
Arkansas	388,000	19.25	7,469,000	674,000	8.00	5,392,000
Montana	75,000	44.00	3,300,000	905,000	22.00	19,910,000
Wyoming	25,000	40.00	1,000,000	872,000	23.00	20,056,000
Colorado	158,000	35.50	5,609,000	1,454,000	19.50	28,353,000
New Mexico	28,000	36.50	1,022,000	939,000	16.00	15,024,000
Arizona	24,000	45.00	1,080,000	639,000	19.00	12,141,000
Utah	85,000	31.50	2,678,000	327,000	17.00	5,559,000
Nevada	18,000	40.25	724,000	404,000	19.00	7,676,000
Idaho	76,000	35.50	2,698,000	347,000	18.50	6,420,000
Washington	195,000	40.00	7,800,000	381,000	18.00	6,858,000
Oregon	169,000	36.00	6,084,000	743,000	17.00	12,631,000
California	430,000	36.00	15,480,000	1,155,000	17.50	20,212,000
United States	21,720,000	32.36	702,945,000	49,379,000	17.49	863,754,000
Division: [a]						
North Atlantic	4,079,000	35.41	144,425,000	2,584,000	17.12	44,232,000
South Atlantic	1,574,000	27.91	43,937,000	3,329,000	14.02	46,688,000
N. C. E. Miss. R	5,200,000	35.80	186,145,000	6,213,000	20.03	124,460,000
N. C. W. Miss. R	6,181,000	31.76	196,278,000	16,071,000	20.25	325,416,000
South Central	3,403,000	24.89	84,685,000	13,016,000	12.92	168,118,000
Far Western	1,283,000	37.00	47,475,000	8,166,000	18.96	154,840,000

[a] See note *a*, page 599.

Wholesale prices of cattle per 100 pounds, 1896–1908.

Date.	Chicago. Inferior to prime. Low.	Chicago. Inferior to prime. High.	Cincinnati. Fair to medium. Low.	Cincinnati. Fair to medium. High.	St. Louis. Good to choice native steers. Low.	St. Louis. Good to choice native steers. High.	Omaha. Native beeves. Low.	Omaha. Native beeves. High.
1896	$1.75	$6.00	$3.00	$3.85	$3.00	$5.10	$3.00	$4.75
1897	1.75	5.75	3.00	4.00	3.25	5.25	3.00	5.20
1898	2.25	6.25	3.10	4.25	4.00	5.65	3.00	5.80
1899	2.00	7.00	3.00	4.50	4.00	6.00	3.75	7.25
1900	1.75	6.60	3.00	4.70	4.00	6.50	3.50	7.50
1901	2.10	7.00	2.90	5.05	4.75	8.25	3.50	7.25
1902	1.90	14.50	3.00	5.40	5.15	8.75	3.00	8.15
1903	1.50	8.35	2.25	4.40	5.00	6.00	2.65	5.75
1904	1.70	7.65	2.25	4.25	4.90	6.60	2.75	6.35
1905.								
January	1.85	6.30	2.65	3.85	5.15	5.50	3.05	5.35
February	1.90	6.45	2.65	4.00	5.15	6.00	3.15	5.25
March	2.20	6.25	2.50	4.40	5.50	5.65	3.20	5.65
April	2.40	7.00	3.50	4.75	5.90	6.75	3.25	6.50
May	2.35	6.85	3.15	4.65	5.85	6.50	3.75	6.30
June	2.30	6.35	3.00	4.25	5.25	6.50	3.70	5.95
July	2.00	6.25	3.00	4.40	5.25	5.85	3.50	5.40
August	2.10	6.30	2.85	4.10	5.50	5.70	3.25	6.15
September	2.00	6.50	2.75	4.00	5.50	6.35	3.40	5.90
October	2.10	6.40	2.50	3.85	6.00	6.15	3.10	5.75
November	2.15	6.60	2.35	3.75	5.40	6.15	3.50	6.50
December	2.15	7.00	2.65	4.00	5.50	7.10	3.05	5.60
1906.								
January	2.00	6.50	2.85	4.00	5.45	6.00	3.10	5.50
February	2.10	6.40	3.25	4.35	5.65	6.00	3.00	5.60
March	2.25	6.35	3.25	4.50	5.75	6.00	3.10	5.60
April	2.35	6.35	3.00	4.40	5.50	5.75	3.35	5.50
May	2.50	6.20	3.00	4.35	5.45	5.80	3.50	5.65
June	1.75	6.10	2.75	4.00	5.50	6.00	3.35	5.70
July	2.00	6.50	2.60	4.40	5.85	6.10	3.10	6.25
August	2.00	6.85	2.50	4.25	5.85	6.30	3.05	6.25
September	2.05	6.95	2.50	4.40	6.25	6.40	2.90	6.40
October	2.00	6.95	2.40	4.35	6.15	6.75	3.75	6.35
November	1.75	7.40	2.35	4.50	5.85	7.00	3.25	6.40
December	1.75	7.90	2.75	4.50	6.00	7.00	3.00	6.85
1907.								
January	2.00	7.30	4.60	5.40	6.10	6.55	3.10	6.10
February	2.00	7.25	4.40	5.25	5.75	6.10	3.20	5.85
March	2.00	6.90	4.65	5.50	6.00	6.25	3.25	5.80
April	2.50	6.75	4.75	5.70	5.85	6.25	3.80	5.85
May	2.20	6.50	4.65	5.60	5.90	6.05	3.75	6.10
June	2.25	7.10	4.75	5.75	6.00	6.85	4.25	6.75
July	2.00	7.50	5.00	5.90	6.90	7.25	3.25	7.10
August	2.00	7.60	4.90	6.00	6.65	7.35	3.35	7.30
September	2.00	7.35	5.00	5.65	6.65	7.00	5.25	7.10
October	2.00	7.45	4.85	5.50	6.70	7.00	4.25	7.05
November	2.00	7.25	4.10	5.00	5.35	6.60	3.50	6.40
December	2.00	8.00	4.15	5.15	5.40	6.75	3.15	5.70
1908.								
January	2.00	6.40	3.25	4.50	5.50	5.80	2.75	5.75
February	2.00	6.25	3.25	4.50	5.70	5.80	2.25	5.55
March	2.25	7.35	3.50	5.00	5.75	7.15	3.10	7.00
April	2.50	7.40	4.00	5.50	6.90	7.35	3.00	7.00
May	2.50	7.40	3.90	5.25	7.00	7.20	3.00	7.05
June	2.50	8.40	4.00	5.25	7.15	8.25	3.00	8.05
July	2.30	8.25	3.50	5.00	7.45	8.00	3.50	8.10
August	2.25	7.90	3.15	4.75	6.75	7.50	2.75	7.00
September	2.10	7.85	2.75	4.25	6.75	7.75	3.25	7.50
October	2.00	7.60	2.65	4.25	6.85	7.50	3.30	7.25
November	2.25	8.00	3.00	4.40	7.10	7.60	3.00	7.25
December	2.30	8.00	3.25	4.75	6.90	8.00	2.50	6.80

SHEEP AND WOOL.

Number and farm value of sheep on farms in the United States, 1867–1909.

Year.	Number.	Price per head Jan. 1.	Farm value Jan. 1.	Year.	Number.	Price per head Jan. 1.	Farm value Jan. 1.
1867	39,385,386	$2.50	$98,643,878	1889	42,599,079	$2.13	$90,640,369
1868	38,991,912	1.82	71,052,570	1890	44,336,072	2.27	100,659,761
1869	37,724,279	1.64	62,036,752	1891	43,431,136	2.50	108,397,447
1870	40,853,000	1.96	79,875,996	1892	44,938,365	2.58	116,121,290
1871	31,851,000	2.14	68,310,110	1893	47,273,553	2.66	125,909,264
1872	31,679,300	2.61	82,767,741	1894	45,048,017	1.98	89,186,110
1873	33,002,400	2.71	89,426,606	1895	42,294,064	1.58	66,685,767
1874	33,938,200	2.43	82,352,976	1896	38,298,783	1.70	65,167,735
1875	33,783,600	2.55	86,278,163	1897	36,818,643	1.82	67,020,942
1876	35,935,300	2.37	85,120,646	1898	37,656,960	2.46	92,721,133
1877	35,804,200	2.13	76,361,698	1899	39,114,453	2.75	107,697,530
1878	35,740,500	2.21	78,897,594	1900	41,883,065	2.93	122,665,913
1879	38,123,800	2.07	78,964,563	1901	59,756,718	2.98	178,072,476
1880	40,765,900	2.21	90,230,537	1902	62,039,091	2.65	164,446,091
1881	43,569,899	2.39	104,070,861	1903	63,964,876	2.63	168,315,750
1882	45,016,224	2.37	106,595,954	1904	51,630,144	2.59	133,530,099
1883	49,237,291	2.53	124,365,835	1905	45,170,423	2.82	127,331,850
1884	50,626,626	2.37	119,902,706	1906	50,631,619	3.54	179,056,144
1885	50,360,243	2.14	107,960,650	1907	53,240,282	3.84	204,210,129
1886	48,322,331	1.91	92,443,867	1908	54,631,000	3.88	211,736,000
1887	44,759,314	2.01	89,872,839	1909	56,084,000	3.43	192,632,000
1888	43,544,755	2.05	89,279,926				

Imports and exports of sheep, with average prices, 1892–1908.

Year ending June 30—	Imports.			Exports.		
	Number.	Value.	Average import price.	Number.	Value.	Average export price.
1892	380,814	$1,440,530	$3.78	46,960	$161,105	$3.43
1893	459,484	1,682,977	3.66	37,260	126,394	3.39
1894	242,568	788,181	3.25	132,370	832,763	6.29
1895	291,461	682,618	2.34	405,748	2,630,686	6.48
1896	322,692	853,530	2.65	491,565	3,076,384	6.26
1897	405,633	1,019,668	2.51	244,120	1,531,645	6.27
1898	392,314	1,106,322	2.82	199,690	1,213,886	6.08
1899	345,911	1,200,081	3.47	143,286	853,555	5.96
1900	381,792	1,365,026	3.58	125,772	733,477	5.83
1901	331,488	1,236,277	3.73	297,925	1,933,000	6.49
1902	266,953	956,711	3.58	358,720	1,940,060	5.41
1903	301,623	1,036,934	3.44	176,961	1,067,860	6.03
1904	238,094	815,289	3.42	301,313	1,954,604	6.49
1905	186,942	704,721	3.77	268,365	1,687,321	6.29
1906	240,747	1,020,359	4.24	142,690	804,090	5.64
1907	224,798	1,120,425	4.98	135,344	750,242	5.54
1908	224,765	1,082,606	4.82	101,000	589,285	5.83

Number, average price, and farm value of sheep on farms in the United States, January 1, 1909.

State, Territory, or Division.	Number.	Average price per head Jan. 1.	Farm value Jan. 1.
Maine	262,000	$3.10	$812,000
New Hampshire	76,000	3.30	251,000
Vermont	227,000	3.60	817,000
Massachusetts	45,000	4.00	180,000
Rhode Island	9,000	4.00	36,000
Connecticut	34,000	4.40	150,000
New York	1,165,000	4.30	5,010,000
New Jersey	44,000	5.00	220,000
Pennsylvania	1,135,000	4.50	5,108,000
Delaware	12,000	4.40	53,000
Maryland	163,000	4.60	750,000
Virginia	517,000	3.80	1,965,000
West Virginia	709,000	4.00	2,836,000
North Carolina	222,000	2.40	533,000
South Carolina	58,000	2.20	128,000
Georgia	258,000	1.90	490,000
Florida	99,000	1.90	188,000
Ohio	3,110,000	4.10	12,751,000
Indiana	1,215,000	4.50	5,468,000
Illinois	793,000	4.80	3,806,000
Michigan	2,130,000	3.90	8,307,000
Wisconsin	1,044,000	3.80	3,967,000
Minnesota	468,000	3.50	1,638,000
Iowa	747,000	4.60	3,436,000
Missouri	997,000	3.90	3,888,000
North Dakota	621,000	3.60	2,236,000
South Dakota	821,000	3.50	2,874,000
Nebraska	409,000	3.50	1,432,000
Kansas	248,000	4.00	992,000
Kentucky	1,071,000	3.80	4,070,000
Tennessee	351,000	$3.20	$1,123,000
Alabama	184,000	1.90	350,000
Mississippi	176,000	1.90	334,000
Louisiana	182,000	1.80	328,000
Texas	1,853,000	2.70	5,003,000
Oklahoma	102,000	3.20	326,000
Arkansas	253,000	2.10	531,000
Montana	5,634,000	3.30	18,592,000
Wyoming	6,591,000	3.40	22,409,000
Colorado	1,695,000	3.10	5,254,000
New Mexico	4,978,000	3.00	14,934,000
Arizona	1,052,000	3.30	3,472,000
Utah	3,115,000	3.30	10,280,000
Nevada	1,554,000	3.00	4,662,000
Idaho	3,897,000	3.40	13,250,000
Washington	799,000	3.40	2,717,000
Oregon	2,634,000	3.10	8,165,000
California	2,325,000	2.80	6,510,000
United States	56,084,000	3.43	192,632,000
Division:[a]			
North Atlantic	2,997,000	4.20	12,584,000
South Atlantic	2,038,000	3.41	6,943,000
N. Central E. of Miss. R.	8,292,000	4.14	34,299,000
N. Central W. of Miss. R.	4,311,000	3.83	16,496,000
South Central	4,172,000	2.89	12,065,000
Far Western	34,274,000	3.22	110,245,000

[a] See note a, page 599.

Prices of sheep per 100 pounds, 1896–1908.

Date.	Chicago. Inferior to choice.		Cincinnati. Good to extra.		St. Louis. Good to choice natives.		Omaha. Native.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1896	$1.50	$4.30	$2.25	$4.00	$2.00	$3.75	$1.50	$3.85
1897	2.00	5.00	2.75	5.00	2.00	4.00	1.75	5.25
1898	2.50	5.25	3.10	4.75	3.00	5.00	2.75	5.25
1899	2.50	5.65	3.00	5.00	3.00	5.60	2.75	5.50
1900	2.00	6.50	1.25	6.00	3.40	6.25	2.00	6.10
1901	2.50	5.15	2.10	5.00	3.00	5.10	2.00	5.00
1902	1.25	6.50	2.50	5.75	3.65	6.35	2.00	6.25
1903	1.25	7.00	2.60	6.25	3.50	6.25	3.00	6.75
1904	1.50	6.00	2.75	4.60	3.75	5.65	2.25	5.90
1905.								
January	4.50	5.85	4.10	5.25	5.15	6.35	3.25	6.25
February	4.50	6.25	4.50	5.50	5.50	6.15	3.00	6.90
March	4.75	6.25	4.75	5.50	5.85	6.25	3.00	6.75
April	4.50	6.30	4.50	5.25	5.25	5.90	2.75	6.75
May	4.00	5.50	3.85	5.00	5.00	5.40	2.50	6.00
June	4.00	5.25	3.60	4.35	4.80	5.00	2.50	5.70
July	4.00	5.90	3.60	4.75	5.00	5.50	4.75	6.00
August	4.00	5.65	3.75	4.50	4.60	5.20	4.00	5.30
September	3.80	5.40	4.00	4.75	5.00	5.00	3.75	5.25
October	4.00	5.70	4.00	5.25	5.25	5.60	4.00	6.00
November	4.25	6.10	4.10	5.00	5.25	5.75	4.25	6.00
December	4.25	6.25	4.10	5.15	5.50	6.00	4.50	6.25
1906.								
January	3.75	6.25	4.50	5.50	5.75	6.25	4.00	4.60
February	3.50	6.25	4.35	5.50	5.50	6.25	3.50	6.25
March	3.50	6.50	5.00	5.75	5.50	6.45	2.75	6.00
April	3.50	6.50	4.00	5.75	5.50	6.00	3.25	6.15
May	3.75	6.50	4.10	4.75	6.00	6.25	4.50	6.40
June	3.50	6.25	4.40	5.25	6.00	6.10	3.80	6.50
July	3.00	6.25	4.10	4.75	5.25	5.75	4.00	6.25
August	3.00	5.60	4.10	4.75	5.00	5.50	4.50	5.85
September	3.50	5.75	4.10	4.75	5.35	5.75	4.25	5.85
October	3.50	5.75	3.85	4.75	5.35	5.50	4.75	5.65
November	3.25	5.75	4.00	4.60	5.50	5.60	4.50	6.10
December	3.00	7.00	4.00	4.75	5.50	6.00	4.75	6.35
1907.								
January	2.25	6.00	4.25	4.65	5.50	6.00	3.50	6.30
February	2.75	6.00	4.50	5.10	5.60	5.85	3.75	6.45
March	3.00	6.50	4.75	5.25	5.65	5.85	3.00	6.50
April	3.50	7.25	5.50	5.90	6.00	6.75	4.00	7.75
May	3.50	7.00	4.75	5.15	6.10	6.50	4.40	6.75
June	3.00	7.00	4.50	4.90	5.85	7.00	4.50	6.75
July	3.25	6.15	4.10	4.65	5.60	5.85	4.00	6.25
August	3.00	6.00	4.55	5.15	5.50	5.75	3.50	6.50
September	3.00	6.00	4.35	4.90	5.50	6.10	3.75	4.65
October	2.00	5.75	4.35	4.90	5.35	5.65	4.00	5.50
November	2.00	5.25	3.85	4.60	5.25	5.35	3.75	5.20
December	2.00	5.25	3.65	4.40	4.25	4.75	3.00	5.00
1908.							Western.	
January	2.50	5.75	4.25	5.00	5.00	5.50	3.00	6.10
February	2.50	5.75	4.50	5.25	4.25	6.35	3.50	6.00
March	3.25	7.00	4.65	5.50	5.25	6.50	4.00	7.40
April	3.00	7.00	4.50	5.25	6.50	6.90	3.50	6.70
May	2.00	6.75	4.10	5.00	4.75	5.90	3.00	6.00
June	2.50	5.60	3.60	4.50	5.00	5.50	2.25	6.10
July	2.50	5.25	3.00	3.85	4.40	4.50	2.00	4.50
August	2.25	5.50	3.25	4.00	4.25	4.65	1.25	4.25
September	2.00	5.15	2.75	3.75	4.15	4.35	1.25	4.10
October	2.00	5.25	3.00	3.75	4.10	4.65	1.25	4.75
November	2.00	5.50	3.00	3.75	4.50	4.65	1.25	4.75
December	2.00	5.50	3.25	4.25	4.50	4.75	2.00	5.50

Wool product of the United States in 1908, by States.

[Estimate of National Association of Wool Manufacturers.]

State or Territory.	Number of sheep of shearing age Apr. 1, 1908.	Average weight of fleece, 1908.	Per cent of shrinkage, 1908.	Wool washed and unwashed.	Wool scoured.
		Pounds.	*Per cent.*	*Pounds.*	*Pounds.*
Maine	215,000	6.00	40	1,290,000	744,000
New Hampshire	70,000	6.20	50	434,000	217,000
Vermont	175,000	6.00	50	1,050,000	525,000
Massachusetts	35,000	5.80	42	203,000	117,740
Rhode Island	7,000	5.00	42	35,000	20,300
Connecticut	35,000	5.00	42	175,000	101,500
New York	850,000	6.00	50	5,100,000	2,550,000
New Jersey	45,000	5.50	50	247,500	123,750
Pennsylvania	950,000	6.00	48	5,700,000	2,964,000
Delaware	7,000	6.00	45	42,000	23,100
Maryland	125,000	5.50	45	687,500	378,125
Virginia	375,000	4.50	38	1,687,500	1,046,250
West Virginia	525,000	5.50	48	2,887,500	1,501,500
North Carolina	205,000	4.25	42	871,250	505,325
South Carolina	50,000	4.00	42	200,000	116,000
Georgia	225,000	3.50	40	787,500	472,500
Florida	100,000	3.00	40	300,000	180,000
Ohio	2,000,000	6.50	49	13,000,000	6,630,000
Indiana	800,000	6.30	45	5,040,000	2,772,000
Illinois	650,000	6.50	50	4,225,000	2,112,500
Michigan	1,500,000	6.40	50	9,600,000	4,800,000
Wisconsin	850,000	6.25	49	5,312,500	2,709,375
Minnesota	375,000	6.75	51	2,531,250	1,240,313
Iowa	800,000	6.50	49	5,100,000	2,601,000
Missouri	852,548	6.70	48	5,712,071	2,970,277
North Dakota	300,000	6.50	60	1,950,000	780,000
South Dakota	650,000	6.50	61	4,225,000	1,647,750
Nebraska	275,000	6.75	64	1,856,250	668,250
Kansas	160,000	7.00	64	1,120,000	403,200
Kentucky	600,000	5.00	39	3,000,000	1,830,000
Tennessee	290,000	4.50	40	1,305,000	783,000
Alabama	175,000	3.25	40	568,750	341,250
Mississippi	150,000	4.00	42	600,000	348,000
Louisiana	155,000	3.70	42	573,500	332,630
Texas	1,300,000	6.75	67	8,775,000	2,895,750
Oklahoma	80,000	6.50	68	510,000	163,200
Arkansas	225,000	4.25	41	956,250	564,188
Montana	4,600,000	7.00	64	32,200,000	11,592,000
Wyoming	4,500,000	8.00	68	36,000,000	11,520,000
Colorado	1,500,000	7.00	68	10,500,000	3,360,000
New Mexico	3,000,000	5.50	64	16,500,000	5,940,000
Arizona	800,000	6.50	65	5,200,000	1,820,000
Utah	2,100,000	7.00	67	14,700,000	4,851,000
Nevada	750,000	8.00	69	6,000,000	1,860,000
Idaho	2,500,000	7.00	67	17,500 000	5,775,000
Washington	480,000	8.50	69	4,080,000	1,264,800
Oregon	2,000,000	8.25	69	16,500,000	5,115,000
California	1,900,000	7.00	66	13,300,000	4,522,000
United States	40,311,548	6.70	60.5	270,138,321	106,630,648
Pulled wool	....	....	30.0	41,000,000	28,700,000
Total product, 1908	....	....	....	311,138,321	135,330,648

Wholesale prices of wool per pound, 1895–1908.

Date.	Boston.		New York.		Philadelphia.		St. Louis.	
	XX Ohio, washed.		XX Ohio.		XX Ohio, washed.		Best tub-washed.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1895	....	....	16	19	16	19	19½	21
1896	17	21	17½	19	16	21	17	21
1897	19	30	17½	31½	19	31	20½	32
1898	27	30	28	31	28	31	25½	30
1899	25½	38	28	33	25½	36	25½	35
1900	27	38	28	39	27	37	28	36
1901	26	28	25½	27	25	28	24	29½
1902	27	32	26	32	26	32	24	29
1903	30	35	28	33	30	34	27	31
1904	32	36	28	35	31½	33½	30½	41
1905.								
January	34	35	32	35	34	36	40	41
February	34	35	32	35	34	35	39	41
March	34	35	31	34	34	35	37	38
April	34	35	31	36	34	35	37	39½
May	34	36	32	36	34	36	39	43
June	36	37	32	36	34	36	41	42½
July	35	37	32	39	35	36	41	42
August	36	37	35	39	35	36	41½	41½
September	36	37	35	38	35	36	42	42
October	36	37	35	38	34	35	42	42½
November	35	36	34	38	34	35	41	42
December	35	36	35	38	34	35	41	41½
1906.			(a)					
January	34	36	35	38	34	35	33	35
February	34	34½	35	38	34	35	31	35
March	34	34½	35	38	34	35	36	38
April	34	34½	35	38	34	35	36	38
May	34	34½	35	38	34	35	38	40
June	34	34½	35	38	34	34½	38	39
July	34	35	35	38	33½	34	38	38½
August	34	35	35	38	33½	34	37	38½
September	34	34½	35	38	33½	34	37	38
October	33½	34½	35	38	33½	34	37	38
November	33½	34	35	38	33	34	37	37½
December	34	34½	35	38	33	34	38	38
1907.								
January	34	34½	35	39	33½	34	38	38
February	34	34½	35	39	33½	34	38	38
March	34	34½	35	39	33½	34	37	38
April	34	34½	35	39	33½	34	36	38
May	33	34½	32	39	33½	34	36	37
June	33	34	31	38	33	34	36	37½
July	33	34	31	34	33	34	36	36½
August	34	35	32	35	33	34	36	36½
September	34	35	32	35	33	34	35	36
October	34	35	32	35	33	34	36	36
November	34	35	32	35	33	34	33	35
December	34	35	32	35	33	34	33	33
1908.								
January	34	35	32	35	33	34	33	33
February	33	34	31	35	33	33½	33	33
March	33	34	31	34	32½	33	30	33
April	32	34	31	35	32	32½	24	30
May	30	32	29	34	31	32	22	25
June	30	32	28	31	30	31	25	27½
July	32	33	30	33	31	32	27	27
August	32	33	30	33	32	33	27	27
September	32	33	30	33	32	33	26	27
October	32	33	30	32½	32	33	26	27
November	32½	33	30	33½	32	33	26	29
December	32½	35	31	34	33	33½	28	30

a XX washed.

Range of prices of wool per pound in Boston, 1896–1908.[a]

Date.	Ohio fine, unwashed.		Indiana quarter-blood, unwashed.		Ohio XX, washed.		Ohio No. 1, washed.		Ohio Delaine, washed.		Michigan fine, unwashed.[b]		Fine selected Territory, staple scoured.		Fine medium Territory, clothing scoured.		Texas, 12 months, scoured.		Fine free fall, Texas or California, scoured.		Pulled, A super, scoured.		Pulled, B super, scoured.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
1896	12	15	14	18½	17	21	17	22	18	22	14	17½	28	38	25	35	28	36	23	30	28	33	23	29
1897	13½	21	16½	24	19	30	21	30	20	30	16½	24	36	58	30	52	33	55	26	45	31	48	28	43
1898	18	21	20	24	27	30	29	31	28	32	21	25	46	57	42	52	42	53	35	45	40	48	32	43
1899	16	26	20	28	25½	38	28½	39	27	40	20	30	42	75	38	62	40	65	30	52	40	57	30	52
1900	18	26	23	29	27	38	28	39	27½	40	21½	29	49	74	45	62	48	65	40	55	42	57	37	50
1901	16½	19½	19½	24	26	28	25	29	27½	30	20	22	43	50	35	44	43	50	36	42	35	45	30	38
1902	19	23	20½	24	27	32	26	31	28	35	21	27	48	59	42	50	48	60	38	48	38	46	33	40
1903	20	25	22	25	30	35	29	34	33½	37	21	27½	52	60	50	58	53	60	44	48	40	47	39	44
1904	21	25	24	33	32	36	30	40	34	38	19	22	50	70	50	68	52	68	44	56	43	60	40	55
1905.																								
January	24	25	31	33	34	35	38	39	37	38	21	22	68	70	62	63	65	68	55	56	58	60	53	55
February	24	25	31	32	34	35	38	39	36	38	21	22	65	70	60	63	63	68	54	56	57	60	52	55
March	23	25	30	32	34	35	36	37	36	37	20	22	65	68	60	62	63	65	54	56	55	60	52	54
April	23	24	30	31	34	35	36	37	36	37	20	21	65	70	60	63	63	68	54	56	55	60	52	54
May	23	27	30	35	34	36	36	38	36	39	20	25	68	74	62	67	67	72	54	56	58	65	52	58
June	26	30	34	36	36	37	37	42	39	40	25	27	73	76	65	70	70	75	54	60	58	62	55	58
July	27	28	33	37	35	37	39	43	38	40	25	26	73	78	67	70	74	76	57	63	58	62	55	58
August	27	28	34	36	36	37	40	42	39	40	25	27	76	78	67	72	74	76	62	63	60	63	56	60
September	27	28	34	35	36	37	40	42	39	40	25	26	76	78	68	72	74	76	62	63	62	63	58	60
October	27	28	34	35	36	37	41	42	37	39	25	26	76	78	68	72	74	76	62	63	62	63	57	60
November	27	28	34	35	35	36	41	42	36½	37	25	26	76	78	66	70	74	76	62	63	62	63	55	57
December	27	28	33	34	35	36	39	42	36½	37	25	26	76	78	66	70	74	76	62	63	62	63	54	56
1906.																								
January	26	28	33	34	34	36	39	40	36½	37	25	26½	75	78	65	68	74	76	62	63	62	63	53	56
February	26	26½	32	34	34	34½	39	40	36½	37	26	26½	75	76	66	68	74	76	62	63	60	63	52	55
March	24	26	32	32½	34	34½	39	40	36½	37	24	25	72	73	66	68	72	73	62	63	60	62	52	55
April	24	25	32	32½	34	34½	39	40	36½	37	24	25	72	73	66	68	72	73	62	63	60	62	52	55
May	24	26	32	32½	34	34½	37	40	36½	37	24	25	72	73	66	68	72	73	62	63	60	64	52	55
June	24	25	32	32½	34	34½	37	38	36½	37	24	25	72	73	66	70	72	73	62	63	60	64	52	55
July	24	25	32	34	34	35	37	38	36½	37	24	25	72	75	68	70	72	73	62	63	60	64	52	55
August	24	26	33	34	34	35	40	41	36	37	24	26	73	75	68	70	72	73	62	63	60	64	51	55
September	25	26	33	34	34	34½	40	41	36	37	25	26	73	75	68	70	72	73	58	63	60	64	50	55
October	24	26	30	34	33½	34½	40	41	35½	37	24	26	70	75	65	69	72	73	58	60	57	64	49	55
November	24	25	30	31½	33½	34	40	41	35½	36½	24	25	70	72	65	67	72	73	58	60	56	69	47	53
December	24	25	31	32	34	34½	40	41	36½	37½	24	25	70	73	66	68	72	73	58	62	53	59	47	53

1907.																								
January	25	27	32	34	34	34½	40	41	37	38	24	25	72	75	66	70	72	75	60	62	56	58	46	52
February	26	27	32	34	34	34½	40	41	37	38	25	25	72	75	68	70	73	75	60	62	56	60	47	52
March	26	27	31	33	34	34½	39	40	37	38	25	25	72	73	68	73	72	75	58	60	53	60	45	52
April	26	27	31	33	34	34½	39	40	37	38	24	25	72	73	68	70	72	74	58	60	53	58	45	50
May	25	27	30	33	33	34½	38	40	36	38	24	25	70	73	68	70	72	74	57	60	53	58	45	50
June	25	26	30	31	33	34	38	39	36	37½	23	24	70	73	68	70	70	73	57	58	53	58	43	47
July	25	28	30	31	33	34	38	39	37	38	24	25	72	73	68	70	72	73	57	58	53	58	44	47
August	26	27	29	31	34	35	39	40	38	39	24	26	72	75	68	72	72	73	57	58	55	58	43	47
September	27	27	29	31	34	35	39	40	38	39	25	26	72	73	70	72	72	73	57	58	52	58	43	45
October	27	27	29	30	34	35	39	40	38	39	24	26	72	73	70	72	72	73	57	58	52	57	43	45
November	26	27	29	30	34	35	39	40	38	39	24	25	72	73	70	72	72	73	52	58	50	57	42	45
December	26	27	29	30	34	35	39	40	38	39	24	25	70	73	68	72	72	73	50	55	45	55	38	45
1908.																								
January	26	27	28	30	34	35	38	40	38	39	24	25	70	72	58	62	70	72	50	53	46	55	38	45
February	24	27	26	30	33	34	37	39	37	38	22	25	65	70	53	57	68	70	48	52	45	48	35	40
March	24	26	25	28	33	34	37	38	37	38	22	24	63	68	53	55	63	65	48	50	44	48	35	40
April	22	25	23	26	32	34	35	38	35	37	21	23	58	65	48	55	56	65	43	48	44	48	35	40
May	19	21	20	24	30	32	31	35	31	34	18	20	54	60	43	48	50	56	42	45	44	48	32	38
June	19	20	20	24	30	32	31	32	31	34	18	20	53	57	43	48	50	52	42	43	44	45	32	37
July	21	23	23	25	32	33	33	35	33	36	20	22	55	60	45	48	50	55	42	43	44	46	32	38
August	20	23	24	25	32	33	34	35	35	36	20	22	57	60	45	48	52	53	42	43	43	45	35	38
September	20	22	23	24	32	33	34	35	34	36	19	21	57	58	43	45	50	53	42	43	42	45	35	38
October	21	22	23	25	32	33	34	35	34	35	20	21	57	60	45	50	50	54	42	43	42	48	35	40
November	21	22	24	27	32½	33	34	35	34	36	20	21	57	63	47	52	51	60	42	50	43	50	36	45
December	21	24	25	27	32½	35	34	39	35	37	20	22	62	65	49	52	60	62	45	47	47	55	39	45

a From Commercial Bulletin, Boston.

b Quoted as X, washed, to June, 1903.

International trade in wool, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Algeria	Jan. 1	16,689,429	21,519,315	22,501,034	33,486,857	26,630,952
Argentina	Jan. 1	425,467,795	371,697,065	421,098,234	328,731,186	341,297,532
Australia	Jan. 1	324,563,030	395,130,825	437,167,965	523,026,207	638,570,389
Belgium	Jan. 1	47,107,979	42,081,470	40,023,199	40,098,225	40,778,437
British India	Jan. 1	34,863,492	37,863,072	39,212,655	44,870,964	44,194,774
Cape of Good Hope [b]	Jan. 1	79,698,393	78,411,050	74,311,616	104,516,265	116,472,023
Chile	Jan. 1	7,350,210	6,993,060	20,753,848	28,978,611	31,762,088
China	Jan. 1	28,131,766	38,042,933	46,404,400	46,205,733	39,429,333
France	Jan. 1	70,346,942	74,093,959	72,227,925	79,511,478	[c] 84,686,586
Netherlands	Jan. 1	42,214,830	33,032,572	30,778,915	28,099,091	21,718,591
New Zealand	Jan. 1	155,128,381	126,834,850	145,257,159	159,849,207	177,535,594
Peru	Jan. 1	9,257,920	7,951,060	9,944,067	10,066,289	[d] 10,066,289
Russia	Jan. 1	30,071,056	35,298,276	32,423,264	41,919,341	[c] 28,601,338
Spain	Jan. 1	25,096,103	28,808,285	43,825,033	26,552,450	[c] 32,203,800
Turkey	Mar. 1	[e] 40,621,737	[e] 40,621,737	40,156,583	[d] 40,156,583	[f] 40,156,583
United Kingdom	Jan. 1	35,950,200	37,858,500	35,251,500	29,808,700	31,148,692
Uruguay	Jan. 1	92,124,262	99,148,322	72,917,218	90,743,833	[d] 90,743,833
Other countries		144,517,000	148,748,000	156,086,187	105,659,951	[c] 86,216,510
Total		1,609,200,525	1,624,134,351	1,740,340,802	1,762,280,971	1,882,213,344

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Austria-Hungary	Jan. 1	61,887,928	62,501,474	59,692,125	81,968,287	[c] 90,187,338
Belgium	Jan. 1	119,472,000	117,205,945	140,786,550	134,875,551	148,253,340
British India	Jan. 1	14,381,600	13,841,838	16,757,543	22,387,912	20,626,006
Canada	Jan. 1	7,539,950	7,578,384	6,867,270	5,164,318	6,406,325
France	Jan. 1	524,434,503	466,088,531	480,776,007	538,280,408	[c] 552,086,732
Germany [g]	Jan. 1	425,726,618	413,781,976	446,726,304	438,284,806	439,917,329
Japan	Jan. 1	7,282,080	21,281,995	14,085,106	13,413,886	22,684,732
Netherlands	Jan. 1	49,996,876	42,618,842	37,692,892	34,783,842	25,326,248
Russia	Jan. 1	71,607,060	50,207,084	60,795,682	69,585,429	[c] 57,419,352
Sweden	Jan. 1	10,164,381	10,471,454	10,114,559	10,807,835	11,671,223
Switzerland	Jan. 1	10,882,200	11,528,600	10,981,002	11,464,696	10,323,804
United Kingdom	Jan. 1	351,928,151	344,758,631	369,465,005	406,403,772	527,766,993
United States	Jan. 1	173,593,891	186,572,683	246,821,389	196,844,298	188,305,955
Other countries		62,862,000	59,941,000	49,382,190	44,973,075	[c] 47,653,131
Total		1,892,259,238	1,808,378,437	1,950,943,624	2,009,238,115	2,148,628,508

[a] See "General note," p. 605.
[b] British South Africa after 1905.
[c] Preliminary.
[d] Year preceding.
[e] Figures for 1899.
[f] Figures for 1905.
[g] Not including free ports prior to Mar. 1, 1906.

Estimated wool clip of the world, 1901–1906.

[Many difficulties beset the preparation of a statement of the wool clip of the world. Each wool-producing country needs to be treated according to the character of the available information, and hence it may be that for one country the census may have ascertained the fact, for another country the production may have been estimated by an expert, for another country it may not be possible to do more than to take exports, and for still another country the best that can be done is to take the number of sheep—itself, perhaps, an estimate—and multiply by a weight per fleece, which may or may not have been determined by commercial experience. The wool included in the following table is that of sheep and lambs, unscoured. No important countries are omitted. The figures for the United States are the estimates of the National Association of Wool Manufacturers.]

[000 omitted.]

Country.	1901.	1902.	1903.	1904.	1905.	1906.
NORTH AMERICA.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
United States	302,502	316,341	287,450	291,783	295,488	298,915
Canada	11,474	11,331	11,060	10,612	10,275	11,210
Central America and West Indies [a]	1,000	1,000	1,000	1,000	1,000	1,000
Hawaii [b]	424	424	424	424	424	424
Mexico [a]	7,000	7,000	7,000	7,000	7,000	7,000
Newfoundland [c]	199	199	199	199	199	199
Total North America	322,599	336,295	307,133	311,018	314,386	318,748
SOUTH AMERICA.						
Argentina [d]	503,443	436,374	425,468	371,697	421,098	328,731
Brazil [d]	2,216	2,143	1,714	2,182	558	1,130
Chile [d]	9,493	17,016	19,663	19,703	20,754	[e] 20,754
Falkland Islands [d]	4,373	4,360	4,024	4,259	4,251	4,324
Peru [d]	2,400	2,059	2,870	7,951	9,940	[e] 9,940
Uruguay [d]	101,867	95,637	98,124	99,148	72,917	66,837
Other [a]	5,000	5,000	5,000	5,000	5,000	5,000
Total South America	628,792	562,589	556,863	509,940	534,518	436,716
EUROPE.						
Austria-Hungary:						
Austria	7,200	7,050	6,900	6,800	6,700	6,600
Hungary	27,600	26,800	26,000	25,500	25,000	[e] 25,000
Bosnia-Herzegovina [a]	10,000	10,000	10,000	10,000	10,000	10,000
Total Austria-Hungary	44,800	43,850	42,900	42,300	41,700	41,600
Bulgaria	21,000	21,750	22,500	23,250	24,000	[e] 24,000
France	90,271	77,507	79,000	78,000	78,000	78,000
Germany	33,600	32,000	30,400	28,800	27,200	25,600
Greece [a]	14,000	14,000	14,000	14,000	14,000	14,000
Italy [a]	21,500	21,500	21,500	21,500	21,500	21,500
Portugal [a]	10,000	10,000	10,000	10,000	10,000	10,000
Roumania [a]	27,500	27,500	27,500	27,500	27,500	27,500
Russia, European	370,000	380,000	375,000	340,000	325,000	320,000
Servia [a]	9,000	9,000	9,000	9,000	9,000	9,000
Spain	53,400	53,100	52,800	52,400	52,000	52,000
Turkey, European [a]	30,000	30,000	30,000	30,000	30,000	30,000
United Kingdom	138,483	135,684	133,124	131,963	130,500	133,088
Other [a]	18,000	18,000	18,000	18,000	18,000	18,000
Total Europe	881,554	873,891	865,724	826,713	808,400	804,288
ASIA.						
British India [a]	50,000	50,000	50,000	50,000	50,000	50,000
Chinese Empire [d]	17,929	25,724	25,751	34,797	46,404	42,253
Persia [d]	11,500	11,500	11,648	10,656	12,146	[e] 12,146
Russia, Asiatic [a]	60,000	60,000	60,000	60,000	60,000	60,000
Turkey, Asiatic [a]	45,000	45,000	45,000	45,000	45,000	45,000
Other [a]	1,000	1,000	1,000	1,000	1,000	1,000
Total Asia	185,429	193,224	193,399	201,453	214,550	210,399

[a] Estimated average production.
[b] Census, 1899.
[c] Census, 1901.
[d] Exports.
[e] Data for 1905.

Estimated wool clip of the world, 1901–1906—Continued.

Country.	1901.	1902.	1903.	1904.	1905.	1906.
AFRICA.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Algeria	24,000	28,064	29,984	33,052	31,173	33,184
British South Africa:[a]						
Cape of Good Hope	65,210	79,328	65,524	64,372	63,474	71,913
Natal	10,852	9,482	10,991	10,320	13,713	17,870
Total British South Africa	76,062	88,810	76,515	74,692	77,187	89,783
Egypt[b]	3,000	3,000	3,000	3,000	3,000	3,000
Tunis[c]	1,300	420	1,153	1,221	4,161	3,735
Other[b]	10,000	10,000	10,000	10,000	10,000	10,000
Total Africa	114,362	130,294	120,652	121,965	125,521	139,702
OCEANIA.						
Australia:						
New South Wales	301,942	221,566	227,004	249,140	297,154	326,999
Queensland	70,142	41,659	52,984	63,270	69,681	86,364
South Australia	39,952	36,863	46,066	36,986	37,534	44,603
Tasmania	8,939	8,304	5,917	11,562	10,530	11,360
Victoria	74,879	65,490	54,608	80,482	66,350	67,426
Western Australia	14,049	13,378	13,306	12,501	17,720	15,405
Total Australia	509,903	387,260	399,885	453,941	498,969	552,157
New Zealand	164,012	167,448	177,575	179,430	172,975	143,308
Other[b]	100	100	100	100	100	100
Total Oceania	674,015	554,808	577,560	633,471	672,044	695,565
Total	2,806,751	2,651,101	2,621,331	2,604,560	2,669,419	2,605 418

[a] Figures showing the production of wool for each of the British South African Colonies are not available. The exports of South African colonial wool from Cape of Good Hope and Natal are here given as representing approximately the total South African wool clip.
[b] Estimated average production.
[c] Exports.

SWINE.

Number and farm value of swine on farms in the United States, 1867–1909.

January 1—	Number.	Price per head.	Farm value.	January 1—	Number.	Price per head.	Farm value.
1867	24,693,534	$4.03	$99,637,016	1889	50,301,592	$5.79	$291,307,193
1868	24,317,258	3.29	79,975,643	1890	51,602,780	4.72	243,418,336
1869	23,316,476	4.65	108,430,534	1891	50,625,106	4.15	210,193,923
1870	26,751,400	5.80	155,108,222	1892	52,398,019	4.60	241,031,415
1871	29,457,500	5.61	165,311,698	1893	46,094,807	6.41	295,426,492
1872	31,796,300	4.01	127,453,285	1894	45,206,498	5.98	270,384,626
1873	32,632,050	3.67	119,631,880	1895	44,165,716	4.97	219,501,267
1874	30,860,900	3.98	122,695,085	1906	42,842,759	4.35	186,529,745
1875	28,062,200	4.80	134,581,364	1897	40,600,276	4.10	166,272,770
1876	25,726,800	6.00	154,251,110	1898	39,759,993	4.39	174,351,409
1877	28,077,100	5.66	158,873,410	1899	38,651,631	4.40	170,109,743
1878	32,262,500	4.85	156,577,228	1900	37,079,356	5.00	185,472,321
1879	34,766,100	3.18	110,507,788	1901	56,982,142	6.20	353,012,143
1880	34,034,100	4.28	145,781,515	1902	48,698,890	7.03	342,120,780
1881	36,247,683	4.70	170,535,435	1903	46,922,624	7.78	364,973,688
1882	44,122,200	5.97	263,543,195	1904	47,009,367	6.15	289,224,627
1883	43,270,086	6.75	291,951,221	1905	47,320,511	5.99	283,254,978
1884	44,200,893	5.57	246,301,139	1906	52,102,847	6.18	321,802,571
1885	45,142,657	5.02	226,401,683	1907	54,794,439	7.62	417,791,321
1886	46,092,043	4.26	196,569,894	1908	56,084,000	6.05	339,030,000
1887	44,612,836	4.48	200,043,291	1909	54,147,000	6.55	354,794,000
1888	44,346,525	4.98	220,811,082				

Number, average price, and farm value of swine on farms in the United States, January 1, 1909.

State, Territory, or Division.	Number.	Average price per head Jan. 1.	Farm value Jan. 1.	State, Territory, or Division.	Number.	Average price per head Jan. 1.	Farm value Jan. 1.
Maine	66,000	$8.50	$561,000	Tennessee	1,487,000	$5.00	$7,435,000
New Hampshire	52,000	9.50	494,000	Alabama	1,238,000	5.20	6,438,000
Vermont	98,000	8.25	808,000	Mississippi	1,290,000	4.60	5,934,000
Massachusetts	69,000	9.25	638,000	Louisiana	689,000	4.75	3,273,000
Rhode Island	13,000	10.00	130,000	Texas	3,304,000	5.60	18,502,000
Connecticut	47,000	11.00	517,000	Oklahoma	1,588,000	5.15	8,178,000
New York	669,000	8.50	5,686,000	Arkansas	1,150,000	4.00	4,600,000
New Jersey	158,000	9.25	1,462,000	Montana	68,000	10.00	680,000
Pennsylvania	990,000	8.50	8,415,000	Wyoming	19,000	7.00	133,000
Delaware	46,000	8.00	368,000	Colorado	165,000	7.00	1,155,000
Maryland	287,000	6.60	1,894,000	New Mexico	32,000	6.75	216,000
Virginia	806,000	5.50	4,433,000	Arizona	22,000	7.25	160,000
West Virginia	375,000	6.00	2,250,000	Utah	62,000	7.65	474,000
North Carolina	1,398,000	6.30	8,807,000	Nevada	15,000	9.50	142,000
South Carolina	685,000	6.25	4,281,000	Idaho	143,000	7.25	1,037,000
Georgia	1,615,000	5.50	8,882,000	Washington	197,000	7.50	1,478,000
Florida	447,000	4.00	1,788,000	Oregon	290,000	6.25	1,812,000
Ohio	2,380,000	6.75	16,065,000	California	562,000	6.50	3,653,000
Indiana	3,033,000	6.10	18,501,000				
Illinois	4,438,000	7.00	31,066,000	United States	54,147,000	6.55	354,794,000
Michigan	1,332,000	7.00	9,324,000	Division: [a]			
Wisconsin	1,834,000	8.25	15,130,000	North Atlantic	2,162,000	8.65	18,711,000
Minnesota	1,153,000	7.75	8,936,000	South Atlantic	5,659,000	5.78	32,703,000
Iowa	7,908,000	8.00	63,264,000	North Central E. Miss. R.	13,017,000	6.92	90,086,000
Missouri	3,270,000	5.25	17,168,000				
North Dakota	226,000	8.00	1,808,000	North Central W. Miss. R.	19,752,000	7.20	142,123,000
South Dakota	894,000	7.90	7,063,000	South Central	11,982,000	5.03	60,231,000
Nebraska	3,904,000	7.25	28,304,000	Far Western	1,575,000	6.95	10,940,000
Kansas	2,397,000	6.50	15,580,000				
Kentucky	1,236,000	4.75	5,871,000				

[a] See note *a*, page 599.

Wholesale prices of live hogs per 100 pounds, 1895–1908.

Date.	Cincinnati.		St. Louis.		Chicago.		Omaha.	
	Packing, fair to good.		Mixed packers.					
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1895	$3.65	$5.35	$2.80	$5.35	$3.20	$5.70	$3.20	$5.10
1896	3.15	5.45	2.85	4.25	2.45	4.45	2.50	4.12
1897	3.00	4.45	3.10	4.50	3.00	4.65	2.85	4.17½
1898	3.15	4.45	3.10	4.55	3.10	4.80	3.10	4.60
1899	3.45	4.85	3.40	4.85	3.30	5.00	3.25	4.70½
1900	4.45	5.85	4.40	5.75	3.35	5.85	4.15	5.62½
1901	5.15	7.20	4.90	7.10	3.00	7.40	4.45	6.85
1902	5.85	8.00	5.80	8.20	4.40	8.20	5.25	8.05
1903	4.15	7.75	4.20	7.60	3.75	7.85	4.10	7.55
1904	4.35	6.25	4.25	6.30	3.60	6.37½	4.20	6.05
1905.								
January	4.60	4.95	4.75	5.02	3.90	5.00	4.30	4.85
February	4.80	5.35	4.97	5.20	4.10	5.15	4.40	5.00
March	5.00	5.65	5.25	5.57	4.15	5.55	4.50	5.25
April	5.25	5.80	5.60	5.70	4.50	5.72½	5.10	5.40
May	5.30	5.60	5.40	5.57	4.60	5.65	5.00	5.37½
June	5.30	5.55	5.42	5.65	4.50	5.65	4.90	5.35
July	5.45	6.20	5.75	6.20	4.80	6.15	5.05	5.70
August	5.90	6.35	6.30	6.35	5.25	6.45	5.50	6.10
September	5.15	6.25	5.60	6.00	4.40	6.20	4.85	5.75
October	4.95	5.70	5.15	5.55	4.40	5.80	4.75	5.37½
November	4.80	5.15	4.95	5.12½	4.20	5.25	4.50	5.00
December	4.80	5.45	5.00	5.30	4.50	5.35	4.65	5.00
1906.								
January	5.30	5.80	5.10	5.45	4.60	5.70	4.85	5.50
February	5.65	5.45	5.35	6.20	5.10	6.40	5.25	6.20
March	6.30	6.75	6.10	6.45	5.50	6.55	5.85	6.37½
April	6.35	6.75	6.25	6.65	5.15	6.82½	6.10	6.55
May	6.25	6.62	6.22	6.57	5.10	6.67½	6.10	6.45
June	6.30	6.85	6.20	6.75	5.25	6.85	6.10	6.60
July	6.65	6.95	6.55	6.97	5.60	7.00	6.15	6.75
August	6.00	6.72	6.05	6.67	5.10	6.80	5.45	6.45
September	6.10	6.80	6.12	6.67	5.25	6.80	5.40	6.45
October	6.10	6.80	6.15	6.70	5.16	6.85	5.92½	6.50
November	6.10	6.50	6.07	6.42	5.20	6.50	5.80	6.27½
December	6.10	6.55	5.95	6.45	5.30	6.55	5.90	6.35
1907.								
January	6.40	7.00	6.20	6.87	5.50	6.97½	6.15	6.90
February	6.80	7.40	6.65	7.22	6.00	7.25	6.67½	7.05
March	6.25	7.25	6.07	7.15	5.50	7.05	6.00	6.90
April	6.50	6.90	6.50	6.85	5.90	6.90	6.20	6.55
May	6.25	6.72	6.25	6.65	5.70	6.65	5.77½	6.50
June	5.75	6.30	5.87	6.47	5.40	6.42½	5.70	6.20
July	5.75	6.55	5.85	6.45	5.20	6.65	5.50	6.30
August	6.10	6.85	5.85	6.80	5.20	6.70	5.35	6.25
September	6.25	6.90	6.00	6.75	4.75	7.00	5.40	6.35
October	5.90	7.10	6.30	7.00	4.00	7.05	5.25	6.50
November	4.15	6.25	4.00	6.45	3.10	6.33½	3.80	5.75
December	4.25	5.35	4.25	5.30	3.50	5.25	4.10	4.80
1908.								
January	4.15	4.70	4.20	4.62	3.95	4.72½	4.06	4.40
February	4.25	4.85	4.20	4.60	4.00	4.70	3.97	4.29
March	4.55	6.30	4.40	6.12	4.15	6.35	4.20	5.78
April	5.50	6.40	3.50	6.15	5.00	6.45	5.26	5.82
May	5.35	5.95	5.30	5.85	5.00	5.90	5.14	5.78
June	5.30	6.60	5.30	5.90	5.05	6.07½	5.23	6.03
July	6.35	7.10	5.90	6.90	5.60	7.10	5.95	6.44
August	6.10	7.15	6.25	6.90	5.60	7.10	6.17	6.53
September	6.00	7.35	6.40	7.35	6.05	7.60	6.43	6.90
October	4.85	7.00	5.10	7.15	4.70	7.20	5.21	6.63
November	5.10	6.20	5.40	6.05	4.65	6.40	5.54	5.89
December	5.25	6.25	5.30	5.90	4.60	6.15	5.30	5.79

EGGS.

Wholesale prices of eggs per dozen, 1895–1908.

Date.	New York. Average best fresh.		Cincinnati.		Chicago. Fresh.		St. Louis. Average best fresh.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1895	11½	34	8	26	9	31	8	25
1896	10½	25	7	17	7½	22	6	19
1897	9¼	25	7	17	8	22	6	18
1898	10	27	8	20	8½	26	8	20
1899	12½	35	8½	24	10	35	9	22
1900	12	29	9	22	10	26	8	23
1901	13	31	9	27	10	28	6	25
1902	15½	37	13	32	13¼	33½	11¼	32
1903	15	45	12	28	10	30	11	28½
1904	16	47	14½	32	11	34½	13	29
1905.								
January	22	40	22	27	18	31	22	29
February	24	40	24	30	20	36	28	34
March	17	40	14½	23	14½	31	14	22½
April	17½	21	15	16	14½	19	14½	15½
May	17½	21	15	16	14	18½	12½	16½
June	16½	22	14½	15	12	17½	14	15½
July	16½	25	14	14½	12	20½	10½	14
August	18	28	14	17	12½	22	14	16½
September	20	30	17	19	13	22½	16½	16½
October	21	35	18½	23	15	25	16½	19
November	25	40	23	28	16	30	19	24
December	26	40	24	27	18	31	22½	24
1906.								
January	17½	34	16	24	16	27	14	22
February	15½	27	13	17	11	21½	11½	17
March	14½	22	13	13½	12	17	12	15
April	17	22	14	16½	14	19½	13½	16
May	16	21	14	14½	12	18½	13	14
June	17	23	14	14½	12	19	15	17
July	17	25	14	15½	12	18½	12½	13
August	18	28	14½	18	12	20½	13	15
September	21	33	19	21	12	24½	15	17½
October	20	35	22	24	15	27	18	22
November	20	42	28	29	20	32	20	26
December	22	45	25	29	20	36	21	26
1907.								
January	25	36	22	25	23	28	21	22½
February	25	32	20	24	24	30	16½	25½
March	17	30	15	16	16	22	14	17
April	16½	21	14½	15	15	17½	13½	16
May	16½	21	13½	15	14½	17	13	14
June	16	20	13½	....	13	15	12	13
July	16	26	14½	15	13	16	12	13
August	18	30	15	20	16	20	12	16
September	20	32	20	21	18½	21½	16	17½
October	23	45	21	23	21	24	17½	18½
November	26	50	25	28	22	26	19	21
December	25	50	26	29	22	27	20	23
1908.								
January	23	38	19	26	21	30	18	21
February	20	32	18	23	19½	27	17	23
March	15	29	13	18	14	22½	13	17
April	15½	20	13	14	14¼	16¼	13	13½
May	16½	21	13½	15½	14½	17	13	14
June	15	24	13½	17	14	17½	12½	14
July	17	26	14	17	15½	19½	13½	14½
August	18	30	14	21	17½	20½	14½	16
September	19	35	19	24	19	23	16	18½
October	22	44	22	28	22	27	18½	23
November	24	50	23	34	26	30	23	27
December	28	55	25	36	28	33	25	29

BUTTER AND CHEESE.

Wholesale prices of butter and cheese per pound, 1895–1908.

Date.	Butter.								Cheese.							
	New York.		Cincinnati.		Chicago.		Elgin.		New York.		Cincinnati.		Chicago.		St. Louis.	
	Creamery extra.		Creamery.		Creamery firsts.		Creamery extra.		September, colored.		Factory.		Young Americas.a		Full cream.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
1895	17	26½	13	21	14½	26½	......	......	6	11½	7	10½	6	11	8¼	11¼
1896	14	25	12	20	12	24	14	24½	6⅝	10¾	7	10	5¼	10½	7¼	10½
1897	15	24	12	22	12½	23	13⅝	23	7⅜	12¼	7	11	3	11	8	11¾
1898	15	23½	13	20	14	22	15	22	6⅝	10½	7	11	3	11	8	10½
1899	16½	28	16	24	14	27	16	27	7½	13	8	12½	8	13	9	13
1900	17½	30	16	27	15½	29	18	29	9	13½	8½	12½	7	12½	10	12½
1901	18	25½	17	24	15	24½	18½	24½	8½	12½	8½	12	9	11¾	10	12
1902	19	33	17	27	16	31	19	30	9½	13½	10½	13	9½	13	10¾	11½
1903	19	29½	15½	27	16	28½	18½	29	10	15	10½	12¾	9	13¾	11½	11¾
1904	17½	28	17	28	15	28	17	28	7	12	8	10½	7¼	11½	9	13½
1905.																
January	28	30½	28	30½	22	30	28	29½	11½	11¾	12½	13	11¾	12	13½	13¾
February	29½	35½	30	34	25	34	29	34	11¾	13¼	12½	13	11¾	13½	13¾	14½
March	25	31½	24	30	22	32	25	33	13¾	14½	12½	11¼	......	13½	14½	15
April	27	32	26	32	22	31	27	31½	13¾	14¼	14	11¼	13½	14	14	15½
May	20¾	27	20½	25	18	24	21	25	14¼	14¼	14	14¼	10	14	11½	15½
June	19½	21½	19	21	18	20½	19½	20½	9	9¾	10	12¼	10	10½	11¼	11½
July	20½	21¼	19½	20½	18	20½	20	20	9½	11⅛	10	10¼	10¼	11¼	11¾	12¼
August	20½	22	20	21½	18½	21	20	21	10¼	12	11	11¼	11	11¾	12	12½
September	20¼	21¾	20	21½	18	21	20½	21	11¾	12	11	12½	11½	11¾	12½	12¾
October	20	22	20½	23	19	22	21	22½	11½	13¼	12	12½	11½	12¼	12½	13½
November	17½	24½	22	24½	20	23	22½	24	13¼	13¾	13½	14	13	13¾	14	14
December	24	26	23½	25	19	24½	24	25	12	14	13½	14	13	13½	13¼	13½
1906.																
January	25	27½	25½	27	20	27	26	27	14	14½	12½	13½	......	13	13¼	13¼
February	26	27½	26½	29½	22	27½	27	28½	14	14¼	13½	......	......	13	13¼	13¼
March	27	27½	27	28	21	27½	27	28½	14	14¼	13½	......	11½	13	13	13¼
April	21	25½	21	27	17	26½	21	26	14¼	14¼	13½	......	11	12	12¼	13

May	19¼	22	19	22	16½	20	19	21	9½	14¼	11	13½	9½	11¾	11¼	12¼
June	19¼	21	19½	21	16½	21	19½	20	9½	11	11	....	10½	11½	11⅝	12½
July	20½	21½	20	22½	18	20	20	21½	11	11½	11	....	11¼	11¾	12½	12¼
August	21	24½	21½	24	18	23	21½	23	11½	12¾	12	13	12	12¾	12¾	11
September	24	25½	24	25½	20½	24	24	24½	12½	13	13	....	12¼	12½	13½	11
October	25½	27	24½	27	22	25½	24½	26	13¼	13½	13	13¾	12½	13¼	14	11½
November	27	30½	26	31	22	28½	26	30	13¼	14	13½	13¾	13	13¾	14¼	15¼
December	30½	33	30	32½	25	31	30	31½	14	14½	13½	14	13½	14	15¼	15¼
1907.																
January	28	33	29	33	22	31	29	32	14½	14½	14½	15	14	14¼	15¼	15¾
February	32½	34	32	34	23	32½	32	33	14½	14¾	14½	15	14¼	16	15	16½
March	29½	34	30	32	25	32½	30	32	14¾	15	15	15½	15	16	15	16½
April	27	35	27	31	25	32½	27	33	15	15	15	15½	14½	15½	12¼	13
May	24½	27½	23	26	18	25	23	25	12	15	14	15½	14	15	15	15¾
June	23½	25	23	24½	18	24	23	23	11¾	12½	13½	14	13	14	14	14½
July	24½	27	26	27	18	25	24	25	12¼	12¾	13½	14	13	13½	14¼	15
August	24½	26½	26	27½	20	25	24	26	12	13½	14	....	....	13½	14½	14¾
September	26	29½	28	30½	21	28½	26	28½	13¾	14¾	14	....	13½	14¼	14¾	15¼
October	26	30	29	32	22½	29½	27	30	11¾	16¼	14	15½	14	15½	14¾	16½
November	24½	28	26	29	20	27	24	27	15¼	15¾	15½	....	12½	15½	13¾	14¾
December	28	29½	29	31	21	29	27	29	15¼	15¾	15½	....	11½	13	13	14
1908.																
January	29	32½	29	34½	24	31	29½	32	15¾	15¾	14½	16½	12½	13	14	14
February	30	34	32	36	26	33½	32	33	15	15¾	14½	16½	12½	12¾	13¾	14
March	28	30	29	34½	25	31	29	31	15¾	16	14½	16½	12¾	13¾	14	14½
April	26½	30½	26½	32½	22	30	26½	30	14½	16	14½	16½	11	13¾	13	14¼
May	21½	26½	22	28½	19	25	22	26	14¼	15	14½	16½	11	12½	13	13
June	22	24	23	25½	20	23	23	23	10½	11½	12	16¼	11½	12½	12½	13
July	22	23	22	25½	20	22½	22	23	9¾	12¼	12½	13½	11½	12	12½	14
August	21¼	23½	21	25½	19	22½	21	23	11	12	12½	13½	12¼	13	13¾	14
September	23½	25½	23	28½	20	24	23	26	11	13	12½	14	12¾	13½	13¾	14½
October	26	27½	25½	30	21	27½	27½	27½	11¼	13	13½	14	13¼	14	14¼	14½
November	27	31	27	32½	22	30	28	30	11¼	14	13½	15	13½	14¼	14½	15
December	30½	33	29½	34½	25	31	30	32	11¾	14	14	15	14	14½	15	15¼

a Full cream, 1895 to 1900.

International trade in butter, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	11,750,944	11,672,157	11,890,040	9,712,076	6,691,980
Australia	Jan. 1	30,901,910	64,788,542	55,904,151	75,765,536	66,082,383
Austria-Hungary	Jan. 1	13,728,181	11,233,431	8,944,151	9,501,920	[b] 7,095,355
Belgium	Jan. 1	4,492,080	4,340,012	3,800,594	3,704,232	3,755,227
Canada	Jan. 1	24,093,115	32,544,816	34,806,671	21,680,489	4,835,497
Denmark	Jan. 1	176,664,571	179,745,595	176,081,731	175,043,639	188,829,579
Finland	Jan. 1	22,700,563	26,891,790	35,135,901	33,192,114	[b] 28,024,833
France	Jan. 1	59,714,579	49,842,670	49,781,584	39,307,326	[b] 39,352,944
Germany [c]	Jan. 1	2,796,343	1,766,564	1,834,907	953,058	535,062
Italy	Jan. 1	14,176,381	12,375,425	13,359,789	10,746,430	7,835,006
Netherlands	Jan. 1	51,659,135	52,053,041	51,162,980	56,404,861	64,809,205
New Zealand	Jan. 1	31,931,872	35,208,320	34,240,864	35,865,200	36,785,392
Norway	Jan. 1	2,717,219	3,367,075	3,612,714	3,281,403	2,864,267
Russia	Jan. 1	90,863,488	87,705,713	86,966,484	115,972,393	[b] 131,378,366
Sweden	Jan. 1	44,248,776	43,144,662	40,636,298	35,712,817	38,227,303
United States	Jan. 1	9,345,416	13,880,287	16,194,483	24,468,023	3,857,288
Other countries	....	2,982,000	2,457,000	3,637,216	3,802,267	[b] 3,931,478
Total	....	594,766,573	633,017,100	627,990,558	655,113,784	634,891,165

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
Australia	Jan. 1	1,887,148	43,873	592,201	70,143	20,885
Belgium	Jan. 1	9,788,817	9,727,714	10,054,979	11,128,520	12,529,438
Brazil	Jan. 1	5,496,134	5,642,179	6,567,718	5,344,412	5,452,030
Cape of Good Hope [d]	Jan. 1	6,055,075	5,294,516	5,251,721	11,273,748	7,533,108
Denmark	Jan. 1	12,786,808	13,007,270	12,566,345	13,049,158	8,429,437
Dutch East Indies	Jan. 1	2,945,909	3,021,377	2,957,073	3,433,031	[e] 3,433,031
Egypt	Jan. 1	2,366,386	3,126,945	3,066,949	2,958,784	3,521,070
France	Jan. 1	10,260,344	10,067,424	10,066,650	11,402,808	[b] 14,671,980
Germany [c]	Jan. 1	53,558,205	75,705,838	79,524,904	80,896,179	85,565,569
Natal [f]	Jan. 1	2,121,121	3,171,875	2,142,003	....	....
Netherlands	Jan. 1	2,665,917	5,858,391	5,439,836	5,630,865	3,332,634
Russia	Jan. 1	838,214	1,158,390	1,103,318	1,914,484	[b] 469,466
Sweden	Jan. 1	919,839	1,305,925	911,993	1,316,117	1,498,453
Switzerland	Jan. 1	10,970,199	10,889,289	11,955,445	7,732,271	7,844,045
Transvaal [f]	Jan. 1	5,119,642	4,514,468	4,731,433	....	....
United Kingdom	Jan. 1	447,684,496	465,285,968	456,662,976	477,092,448	462,175,280
Other countries	....	14,478,000	11,853,000	17,458,643	17,973,778	[b] 22,937,851
Total	....	589,942,254	629,674,442	631,054,187	651,216,746	639,414,277

[a] See "General note," p. 605.
[b] Preliminary.
[c] Not including free ports prior to Mar. 1, 1906.
[d] Imports of British South Africa after 1905.
[e] Year preceding
[f] Included with British South Africa after 1905.

International trade in cheese, 1903–1907.[a]

EXPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Bulgaria	Jan. 1	7,064,385	6,624,517	7,227,827	6,606,741	5,674,170
Canada	Jan. 1	235,059,368	220,733,248	219,881,232	213,316,430	189,381,875
France	Jan. 1	23,119,970	20,711,480	22,125,152	22,058,487	[b] 30,511,968
Germany [c]	Jan. 1	2,813,539	2,597,927	2,650,397	2,629,673	2,891,803
Italy	Jan. 1	33,158,617	30,299,443	37,696,611	42,314,633	[b] 46,607,032
Netherlands	Jan. 1	109,025,968	103,069,081	98,438,575	104,742,665	113,648,000
New Zealand	Jan. 1	8,375,360	9,466,912	9,918,944	14,695,072	26,525,296
Russia	Jan. 1	1,406,557	1,396,951	1,382,181	1,796,576	[b] 1,300,061
Switzerland	Jan. 1	53,642,863	56,688,989	61,383,731	61,935,107	62,213,331
United States	Jan. 1	19,634,239	19,129,102	8,229,756	22,376,340	10,341,335
Other countries	....	8,832,000	7,048,000	7,503,508	8,359,652	[b] 8,114,222
Total	....	502,132,866	477,765,650	476,437,914	500,831,376	497,209,093

[a] See "General note," p. 605. [b] Preliminary. [c] Not including free ports prior to Mar. 1, 1906.

International trade in cheese, 1903–1907—Continued.

IMPORTS.

Country.	Year beginning—	1903.	1904.	1905.	1906.	1907.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	2,489,821	4,069,223	4,234,616	7,304,669	7,265,746
Australia	Jan. 1	1,141,300	375,642	384,718	304,951	299,711
Austria-Hungary	Jan. 1	7,527,020	8,213,540	9,358,179	8,950,545	[a] 9,114,789
Belgium	Jan. 1	27,994,030	26,304,868	28,488,857	30,333,690	32,278,995
Brazil	Jan. 1	2,903,536	3,043,516	3,120,168	3,784,774	3,631,012
Cape of Good Hope [b]	Jan. 1	4,251,460	3,994,730	3,249,035	5,752,252	4,761,140
Cuba	Jan. 1	2,900,902	3,333,992	4,202,427	4,078,517	5,232,416
Denmark	Jan. 1	2,052,503	2,033,764	1,932,351	1,782,437	1,784,642
Egypt	Jan. 1	6,947,710	8,495,738	9,512,371	10,064,909	8,650,855
France	Jan. 1	48,434,148	49,683,327	43,254,168	44,714,972	[a] 46,087,182
Germany [c]	Jan. 1	35,859,059	39,750,657	44,698,270	48,187,525	44,760,881
Italy	Jan. 1	9,474,363	9,568,500	9,921,901	10,398,982	[a] 10,294,042
Russia	Jan. 1	3,191,252	3,302,985	2,914,736	3,179,913	[a] 3,358,490
Spain	Jan. 1	4,033,420	4,338,306	3,901,938	4,255,835	[a] 4,396,636
Switzerland	Jan. 1	5,879,065	6,567,789	5,530,515	5,541,979	7,048,617
United Kingdom	Jan. 1	296,012,528	280,125,104	267,722,560	289,371,824	259,833,392
United States	Jan. 1	21,531,792	22,450,665	25,731,604	29,975,017	34,238,459
Other countries	....	14,393,000	18,710,000	19,021,937	21,271,863	[a] 21,296,477
Total	....	497,016,909	485,362,346	487,180,351	529,254,654	504,338,482

[a] Preliminary.
[b] Figures for British South Africa after 1905.
[c] Not including free ports prior to Mar. 1, 1906.

TRANSPORTATION.

Tonnage of farm products carried on railways in the United States, 1903–1907.[a]

[Compiled from reports of the Interstate Commerce Commission. Tons of 2,000 pounds.]

Class of products.	Year ending June 30—				
	1903.	1904.	1905.	1906.	1907.
Vegetable matter:					
Cotton	3,175,117	3,005,897	3,962,183	3,428,880	4,332,664
Fruit and vegetables	7,120,190	7,833,914	9,230,535	8,921,262	9,719,117
Grain and grain products—					
Grain	30,188,316	30,493,327	30,906,440	35,856,333	36,715,384
Grain products—					
Flour	7,276,908	7,088,144	6,589,785	7,331,610	7,880,527
Other grain products	4,541,014	4,728,978	4,639,411	5,042,884	5,698,119
Total grain and grain products	42,006,238	42,310,449	42,135,636	48,230,827	50,294,030
Hay	4,641,440	5,228,475	5,191,830	5,479,755	5,847,828
Sugar	2,425,966	2,600,042	2,573,676	2,793,864	2,610,287
Tobacco	863,478	751,297	833,621	882,235	928,151
Other vegetable matter	3,249,749	2,382,511	3,283,230	3,258,761	5,908,281
Total vegetable matter	63,482,178	64,112,585	67,210,711	72,995,584	79,640,358
Animal matter:					
Animals, live	9,803,871	10,190,124	10,611,555	11,089,456	11,727,889
Packing-house products—					
Dressed meats	1,654,912	1,730,576	1,617,395	1,813,485	1,952,538
Hides (including leather)	843,653	911,778	982,267	1,028,148	1,082,585
Other packing-house products	2,258,389	2,365,505	2,502,016	2,480,537	2,312,313
Total packing-house products	4,756,954	5,007,859	5,101,678	5,322,170	5,347,436
Poultry (including game and fish)	653,604	680,829	750,390	867,811	838,905
Wool	357,947	374,854	387,034	353,436	329,786
Other animal products	1,230,517	1,322,412	1,305,086	1,369,952	2,229,470
Total animal products	16,802,893	17,576,078	18,155,743	19,002,825	20,473,480
Total farm products	80,285,071	81,688,663	85,366,454	91,998,409	100,113,844
Total, all freight	638,800,658	641,680,547	715,663,442	820,164,627	893,184,972

[a] Original shipments only; excluding freight received by each railway from connecting railways and other carriers.

Quotations of ocean freight rates on corn, wheat, cotton, and lard from United States ports to Liverpool during 1908.

Article and port.	Mean for month.												Mean for year.
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Corn and wheat (per 60 pounds):	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Boston	5.67	3.41	3.15	3.02	2.63	2.63	2.84	3.15	3.15	3.15	4.60	4.20	3.47
New York	4.46	3.78	3.15	2.49	2.20	2.63	3.15	3.36	3.15	3.15	4.07	2.68	3.27
Baltimore	6.04	4.20	3.94	2.62	2.36	3.68	3.94	3.68	3.94	3.15	3.68	5.25	3.87
New Orleans	7.14	6.30	6.30	6.30	5.78	4.20	5.00	6.30	6.30	6.30	6.30	6.51	6.06
Galveston	6.38	5.25	5.25	5.25	5.25	5.25	5.25	5.25	6.00	6.38	6.38	4.88	5.53
Cotton (per 100 pounds):													
Boston	15.60	10.50	10.00	10.00	10.00	10.00	10.00	10.50	12.00	12.00	12.00	12.00	11.22
New York	18.00	15.60	12.25	12.00	10.40	12.00	12.00	15.40	16.50	15.00	13.00	12.00	13.68
Baltimore	22.25	19.00	15.75	15.00	13.20	12.00	12.00	12.00	21.00	20.00	20.00	20.00	16.85
New Orleans	37.60	36.00	33.00	28.00	25.75	26.25	26.00	26.00	29.40	29.40	33.00	28.40	29.90
Galveston	32.00	31.00	28.00	26.00	26.00	26.00	30.00	30.00	27.00	28.00	30.00	25.00	28.25
Lard, small packages (per 100 pounds):													
Boston	16.88	16.88	16.88	17.55	19.69	19.69	19.69	20.36	22.50	22.50	22.50	22.50	19.80
New York	16.88	16.88	16.88	16.88	19.69	19.69	19.69	19.69	21.80	22.50	22.50	22.50	19.63
Baltimore	19.34	19.69	19.69	19.69	19.69	19.69	19.69	20.25	20.00	22.50	22.50	22.50	20.44
New Orleans	27.00	25.50	25.00	25.00	24.50	23.00	26.00	26.00	26.00	25.00	25.00	24.60	25.22
Galveston	21.00	20.00	19.00	18.00	18.00	18.00	18.00	19.00	20.00	20.00	20.00	18.00	19.08

Live stock and dressed meats, Chicago to New York by rail: Mean rates, in cents, per 100 pounds.

Year.	Cattle.	Hogs.	Sheep.	Horses and mules.	Dressed beef.	Dressed hogs. Refrigerator cars.	Dressed hogs. Common cars.
1881	35	31	61	60	56	......	......
1882	36	29	53	60	57	......	......
1883	40	32	50	60	64	......	......
1884	31	28	44	60	51	......	......
1885	31	26	43	60	54	......	......
1886	33	30	42	60	61	53	48
1887	33	32	40	60	62	59	54
1888	22	26	31	60	46	46	44
1889	25	30	30	60	47	47	45
1890	23	28	30	60	39	39	39
1891	27	30	30	60	45	45	45
1892	28	28	30	60	45	45	45
1893	28	20	30	60	45	45	45
1894	28	30	30	60	45	45	45
1895	28	30	30	60	45	45	45
1896	28	30	30	60	45	45	45
1897	28	30	30	60	45	45	45
1898	28	30	30	60	45.0	45.0	45.0
1899 [a]	25	25	25	60	40.0	40.0	40.0
1900	28	30	30	60	45.0	45.0	45.0
1901	28	30	30	60	42.9	42.9	42.9
1902	28	30	30	60	41.2	41.2	41.2
1903	28	30	30	60	45.0	45.0	45.0
1904	28	30	30	60	45.0	45.0	45.0
1905	28	30	30	60	45.0	45.0	45.0
1906	28	30	30	60	45.0	45.0	45.0
1907	28	30	30	60	45.0	45.0	45.0
1908	28	30	30	60	45.0	45.0	45.0
Mean:							
1881–1885	34.6	29.2	50.2	60	56.4	......	.....
1886–1890	27.2	29.2	34.6	60	51.0	48.8	46.0
1891–1895	27.8	27.6	30.0	60	45.0	45.0	45.0
1896–1900	27.4	29.0	29.0	60	44.0	44.0	44.0
1901–1905	28.0	30.0	30.0	60	43.8	43.8	43.8

[a] Rates did not go into effect until Feb. 1, 1899. Up to that time the 1898 rates governed.

Meats, packed, Cincinnati to New York by rail: Mean rates, in cents, per 100 pounds.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	The year.
1881	35.0	35.0	35.0	30.5	30.5	25.7	21.5	21.5	21.5	21.5	21.5	21.5	26.7
1882	......	21.5	24.3	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	30.5	25.8
1883	30.5	30.5	30.5	29.2	26.0	26.0	26.0	26.0	26.0	26.0	26.7	30.5	27.8
1884	30.5	30.5	23.3	17.5	17.5	18.4	23.0	26.0	26.0	26.0	26.0	26.0	24.2
1885	24.4	21.5	20.0	20.6	18.5	17.5	17.5	21.5	21.5	21.5	22.8	26.0	21.1
1886	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	27.7	26.1
1887	30.5	30.5	30.5	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	27.1
1888	28.0	28.5	26.3	26.0	26.0	26.0	19.9	17.3	15.5	18.8	21.5	23.6	23.1
1889	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1890	26.0	26.0	26.0	26.0	26.0	26.0	26.0	24.8	20.0	20.0	20.0	20.0	23.9
1891	20.0	24.3	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	25.4
1892	26.0	26.0	26.0	26.0	26.0	25.7	21.5	21.5	21.5	21.5	21.5	21.5	23.7
1893	21.5	23.7	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	25.4
1894	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1895	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1896	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1897	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1898	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1899	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	21.5	21.5	21.5	24.9
1900	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1901	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1902	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1903	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1904	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1905	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	23.0	21.5	21.5	25.0
1906	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1907	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
1908	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
Mean:													
1881–1885	30.1	27.8	26.6	24.8	23.7	22.7	22.8	24.2	24.2	24.2	24.6	26.9	25.1
1886–1890	27.3	27.4	27.0	26.0	26.0	26.0	24.8	24.0	22.7	23.4	23.9	24.7	25.3
1891–1895	23.9	25.2	26.0	26.0	26.0	25.9	25.1	25.1	25.1	25.1	25.1	25.1	25.3
1896–1900	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	25.1	25.1	25.1	25.8
1901–1905	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	25.4	25.1	25.1	25.8

Compressed cotton, by rail: Mean rates, in cents, per 100 pounds.

Year.	From New Orleans [a] to—				From Memphis to—	
	Boston.	New York.	Philadelphia.	Baltimore.	New York.	Boston.
1881	58	53	54	54	66.0	71.0
1882	53	48	51	51	61.0	66.0
1883	60	55	53	52	72.0	77.0
1884	60	55	53	52	54.0	59.0
1885	60	55	53	52	56.6	58.0
1886	52	47	45	44	53.0	58.0
1887	50	45	43	42	53.0	58.0
1888	50	45	43	42	47.0	52.0
1889	52	47	45	44	50.5	55.0
1890	55	50	50	50	50.5	55.0
1891	55	50	50	50	50.5	55.0
1892	55	50	50	50	50.5	55.0
1893	55	50	50	50	47.0	52.0
1894	51	50	50	50	50.5	55.5
1895	53	48	48	48	50.5	55.5
1896	55	50	50	50	50.5	55.5
1897	55	50	50	50	50.0	55.0
1898	55	50	50	50	47.0	52.0
1899	52	47	47	47	48.0	53.0
1900	55	50	50	50	50.5	55.5
1901	55	50	50	50	50.5	55.5
1902	55	50	50	50	50.5	55.5
1903	55	50	50	50	50.5	55.5
1904	55	50	50	50	50.5	50.5
1905	55	50	50	50	40.5	45.5
1906	55	50	50	50	40.5	45.5
1907	55	50	50	50	40.5	45.5
1908	55	50	50	50	42.5	47.5
Mean:						
1881–1885	58.2	53.2	52.8	52.2	61.8	66.2
1886–1890	51.8	46.8	45.2	44.4	50.8	55.6
1891–1895	53.8	49.6	49.6	49.6	49.8	54.6
1896–1900	54.4	49.4	49.4	49.4	49.2	54.2
1901–1905	55.0	50.0	50.0	50.0	48.5	52.5

[a] These rates are mainly used for basing purposes.

Corn and wheat: Mean proportional export freight rates per 100 pounds from Kansas City and Omaha to leading Gulf and Atlantic ports during the calendar years 1905–1908.

Destination and article.	From Kansas City.				From Omaha.			
	1905.	1906.	1907.	1908.	1905.	1906.	1907.	1908.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
New Orleans:								
Corn	14.8	[a] 16.5	16.9	17.5	15.8	[a] 17.5	17.9	18.5
Wheat	[b] 16.1	[a] 17.1	17.9	18.5	[b] 17.4	[a] 18.1	18.9	19.5
Galveston:								
Corn	14.8	16.5	16.9	17.5	15.8	17.5	17.9	18.5
Wheat	[b] 16.1	17.1	17.9	18.5	[b] 17.4	18.1	18.9	19.5
Boston:								
Corn	22.2	23.4	23.4	24.0	22.2	23.4	23.4	24.0
Wheat	[c] 25.0	[d] 21.5	24.4	25.0	[c] 25.0	[d] 21.5	24.4	25.0
New York:								
Corn	22.2	23.4	23.4	24.0	22.2	23.4	23.4	24.0
Wheat	[c] 25.0	[d] 21.5	24.4	25.0	[c] 25.0	[d] 21.5	24.4	25.0
Philadelphia:								
Corn	21.2	22.4	22.4	23.0	21.2	22.4	22.4	23.0
Wheat	[c] 24.0	[d] 20.5	23.4	24.0	[c] 24.0	[d] 20.5	23.4	24.0
Baltimore:								
Corn	20.7	21.9	21.9	22.5	20.7	21.9	21.9	22.5
Wheat	[c] 23.5	[d] 20.0	22.9	23.5	[c] 23.5	[d] 20.0	22.9	23.5

[a] From Apr. 25 to Aug. 10, 1906, inclusive, rates used in computing this average include delivery on board ship.
[b] For July 25 to Dec. 31, 1905, inclusive.
[c] For second half of 1905 only
[d] Average based upon rates in force for two periods, amounting together to about 30 days.

Corn and wheat: Mean rates, in cents, per bushel, Chicago to New York.

Year.	Corn.			Wheat.		
	By lake and canal.[a]	By lake and rail.	By all rail.	By lake and canal.[a]	By lake and rail.	By all rail.
1876	8.75	9.68	14.12	9.82	10.19	15.12
1877	9.59	13.42	18.03	11.09	14.75	19.56
1878	8.83	10.45	16.39	9.96	11.99	17.56
1879	10.49	12.20	14.56	11.87	13.13	17.74
1880	13.41	14.43	17.48	13.13	15.80	19.80
1881	7.77	9.42	13.40	8.67	10.49	14.40
1882	6.72	10.28	13.50	7.23	10.91	14.47
1883	8.03	11.00	15.12	9.01	11.63	16.20
1884	6.55	8.50	12.32	7.00	10.00	13.20
1885	6.30	8.01	12.32	6.54	9.02	13.20
1886	8.45	11.20	14.00	9.10	12.00	15.00
1887	8.50	11.20	14.70	9.50	12.00	15.75
1888	6.71	10.26	13.54	7.05	11.14	14.50
1889	6.32	8.19	12.60	6.92	8.97	15.00
1890	5.93	7.32	11.36	6.76	8.52	14.30
1891	6.32	7.53	14.00	6.95	8.57	15.00
1892	5.95	7.21	12.96	6.45	7.59	13.80
1893	7.18	7.97	13.65	7.66	8.48	14.63
1894	4.93	6.50	12.32	5.11	7.00	13.20
1895	4.50	6.40	10.29	4.86	6.96	11.89
1896	5.75	6.15	10.50	6.19	6.61	12.00
1897	4.53	6.92	11.43	5.22	7.42	12.50
1898	[b] 3.81	4.41	9.80	[b] 4.45	4.91	12.00
1899	[b] 5.08	5.83	10.08	[b] 5.81	6.63	11.60
1900	[b] 4.07	4.72	9.19	[b] 4.49	5.10	9.96
1901	[b] 4.61	5.16	9.21	[b] 5.11	5.54	9.88
1902	[b] 4.83	5.51	9.94	[b] 5.26	5.89	10.62
1903	[b] 4.85	5.78	10.54	[b] 5.40	6.37	11.29
1904	[b] 3.63	4.82	10.38	[b] 4.73	5.50	11.12
1905	[b] 4.76	5.19	9.40	[b] 5.53	6.40	9.90
1906	[b] 5.51	5.72	9.52	[b] 6.03	6.35	10.20
1907	[b] 6.12	6.20	10.17	[b] 6.65	7.09	10.90
1908	[b] 5.62	5.79	9.89	[b] 6.05	6.60	10.60
Mean:						
1876–1880	10.21	12.04	16.12	11.17	13.17	17.96
1881–1885	7.07	9.44	13.33	7.69	10.41	14.29
1886–1890	7.18	9.63	13.24	7.87	10.53	14.91
1891–1895	5.78	7.12	12.64	6.21	7.72	13.70
1896–1900	[c] 4.65	5.61	10.20	[c] 5.23	6.13	11.61
1901–1905	[b] 4.54	5.29	9.89	[b] 5.21	5.94	10.56

[a] Including Buffalo charges and tolls.
[b] Excluding Buffalo charges.
[c] Including, in 1896 and 1897, Buffalo charges and tolls.

Average receipts by railroads for freight traffic, in cents, per ton per mile.

Year.[a]	New York Central and Hudson River R. R.	Erie R. R.	Lake Shore and Michigan Southern Rwy.	Pennsylvania R. R.	Chesapeake and Ohio Rwy.	Illinois Central R. R.	Chicago, Rock Island and Pacific Rwy.	Chicago, Milwaukee and St. Paul Rwy.	Chicago and Alton Rwy.	Union Pacific R. R.	Louisville and Nashville R. R.	All railways in the United States.
1876	0.929	0.972	0.722	0.841	1.062	1.587	1.693	1.798	1.438	2.211	1.638	1.217
1877	.954	.898	.813	.954	1.035	1.719	1.563	1.949	1.361	2.135	1.382	1.286
1878	.919	.900	.724	.914	.985	1.616	1.539	1.762	1.354	2.236	1.635	1.296
1879	.793	.779	.641	.823	.860	1.523	1.429	1.704	1.054	1.991	1.528	1.153
1880	.879	.836	.750	.918	.866	1.543	1.209	1.749	1.206	......	1.594	1.232
1881	.783	.805	.617	.857	.892	1.522	1.220	1.702	1.241	2.178	1.503	1.188
1882	.738	.749	.628	.874	.753	1.417	1.281	1.481	1.253	2.102	1.349	1.102
1883	.915	.786	.728	.881	.722	1.433	1.170	1.391	1.128	1.913	1.323	1.205
1884	.834	.719	.652	.804	.672	1.368	1.097	1.293	1.008	1.557	1.344	1.136
1885	.688	.656	.553	.695	.550	1.307	1.043	1.278	1.009	1.420	1.159	1.011
1886	.765	.659	.639	.755	.541	1.157	1.071	1.168	.961	1.266	1.079	.999
1887	.782	.687	.670	.730	.537	1.087	1.012	1.089	.946	1.213	1.075	.984
1888	.753	.716	.861	.723	.541	1.068	.964	1.020	.973	1.170	1.049	1.001
1889	.712	.644	.632	.685	.538	.839	.971	1.067	.525	1.106	.998	.922
1890	.730	.665	.644	.661	.561	.942	.995	.905	.898	1.138	.972	.941
1891	.740	.636	.630	.656	.525	.934	1.039	1.003	.980	1.131	.968	.895
1892	.699	.614	.602	.647	.518	.908	1.055	1.026	.973	1.080	.948	.898
1893	.701	.631	.599	.620	.511	.845	1.039	1.026	.949	1.033	.917	.878
1894	.733	.621	.587	.606	.478	.839	.989	1.037	.974	.970	.876	.860
1895	.726	.604	.567	.565	.425	.808	1.084	1.075	.994	.971	.831	.839
1896	.668	.606	.551	.563	.425	.745	1.017	1.003	.925	.957	.806	.806
1897	.679	.610	.538	.561	.419	.671	.958	1.008	.891	.962	.791	.798
1898	.606	.575	.530	.521	.369	.695	.966	.972	.866	.950	.743	.753
1899	.586	.539	.481	.469	.362	.688	.996	.937	.800	1.016	.727	.724
1900	.558	.588	.490	.504	.343	.650	.987	.930	.794	1.050	.752	.729
1901	.575	.615	.489	.562	.388	.619	1.000	.861	.723	1.042	.772	.750
1902	.632	.664	.503	.590	.402	.622	1.034	.840	.678	.979	.744	.757
1903	.634	.637	.519	.598	.475	.591	1.013	.865	.599	.973	.781	.763
1904	.664	.652	.523	.606	.470	.607	.944	.891	.677	.982	.791	.780
1905	.638	.645	.524	.604	.427	.587	.931	.881	.689	.897	.793	.766
1906	.625	.621	.516	.588	.420	.556	.930	.862	.639	.924	.803	.748
1907	.641	.637	.527	.587	.433	.577	.953	.856	.604	.959	.802	.759
1908 [b]	.611	.628	.523	.570	.432	.586	.932	.812	.610	.962	.779	......
Mean:												
1876-1880	.895	.889	.730	.890	.962	1.598	1.487	1.792	1.283	[c]2.143	1.555	1.237
1881-1885	.792	.743	.636	.822	.718	1.409	1.162	1.429	1.128	1.834	1.336	1.128
1886-1890	.748	.674	.689	.711	.544	1.019	1.003	1.068	.861	1.191	1.035	.969
1891-1895	.720	.621	.597	.619	.491	.867	1.041	1.033	.974	1.037	.908	.874
1896-1900	.619	.584	.518	.524	.384	.690	.985	.970	.855	.987	.764	.762
1901-1905	.629	.643	.512	.592	.432	.605	.984	.868	.673	.975	.776	.763

[a] Beginning with 1888, the years mentioned end on June 30; prior to 1888 they cover different periods for different railways.

[b] Preliminary.

[c] Mean, 1876-1879.

Mean rates on grain, flour, and provisions, in cents, per 100 pounds, through from Chicago to European ports, by all rail to seaboard and thence by steamers, 1899–1908.

Shipped to—	Articles.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
Liverpool	Grain	29.72	29.48	21.47	20.85	22.68	20.19	19.16	18.75	19.22	19.01
Do	Sacked flour	30.12	27.90	23.00	23.50	25.19	21.00	22.40	20.50	21.25	20.75
Do	Provisions	40.50	48.84	36.00	36.25	41.90	36.56	38.49	41.00	40.85	42.57
Glasgow	Grain	32.35	30.98	24.10	21.75	24.43	22.38	20.00	19.25	19.67	18.63
Do	Sacked flour	31.25	31.56	24.38	22.75	25.38	23.20	22.50	23.60	23.91	22.08
Do	Provisions	44.69	55.31	45.16	41.88	46.88	44.06	43.23	45.63	46.88	46.88
London	Grain	30.60	31.10	23.23	21.75	23.56	21.50	20.23	19.25	20.54	19.46
Do	Sacked flour	33.50	35.01	25.50	24.00	25.19	22.25	23.64	22.50	23.63	23.16
Do	Provisions	44.14	55.87	44.75	39.06	44.06	44.06	40.88	46.26	46.26	46.26
Antwerp	do	47.50	51.09	46.25	41.50	49.69	48.28	43.70	47.61	45.56	49.59
Hamburg	do	46.00	50.00	44.00	39.00	47.00	46.00	45.75	49.00	46.00	49.59
Amsterdam	do	47.00	51.00	45.00	40.00	42.00	42.00	45.42	46.00	45.00	45.00
Rotterdam	do	47.00	51.00	45.00	40.00	42.00	42.00	44.53	46.00	45.00	45.00
Copenhagen	do	51.72	55.31	47.75	42.00	49.69	46.88	48.66	51.00	51.00	53.96
Stockholm	do	62.97	64.50	53.25	45.00	52.50	49.69	51.47	53.50	53.00	54.66
Stettin	do	51.72	55.31	47.75	42.00	49.69	46.88	48.18	50.00	49.00	51.85
Bordeaux	do	59.12	64.12	54.25	51.25	56.25	56.25	51.45	53.00	55.00	55.00

Cost of hauling selected products from farms to shipping points in the United States during the crop years 1905-6 to 1908-9.

Product.	Pounds hauled.	Farm value of loads.	Cost of hauling.		
			Per 100 pounds.	Total.	Per cent of farm value of loads.
1908-9:					
Barley	[a]7,207,000,000	$83,178,000	$0.07	$5,045,000	6.1
Corn	[b]31,831,688,000	344,464,000	.07	22,282,000	6.5
Cotton	[c]6,336,072,000	551,238,000	.16	10,138,000	1.8
Flaxseed	[a]1,220,000,000	25,795,000	.08	976,000	3.8
Hemp	[c]11,750,630	546,000	.06	7,000	1.3
Hops	[c]39,000,000	4,000,000	.11	43,000	1.1
Oats	[b]7,826,176,000	115,436,000	.07	5,478,000	4.7
Peanuts	[d]263,000,000	7,271,000	.12	316,000	4.3
Rice	[a]943,000,000	17,016,000	.11	1,037,000	6.1
Tobacco	[c]718,061,000	74,130,000	.10	718,000	1.0
Wheat	[b]23,606,640,000	364,723,000	.09	21,246,000	5.8
Wool	[c]311,138,000	44,804,000	.44	1,369,000	3.1
Total, 1908-9	80,313,525,000	1,632,601,000	.09	68,655,000	4.2
1907-8	70,198,700,000	1,485,534,000	.09	60,238,000	4.1
1906-7	89,695,509,000	1,537,381,000	.08	75,525,000	4.9
1905-6	85,488,000,000	1,414,990,000	.09	72,984,000	5.2

a Crop of 1908, less an estimated quantity retained for seed.
b Quantity of crop of 1908 shipped out of county where grown.
c Entire crop of 1908.
d Entire crop of 1899, census.

Average cost of hauling products from farms to shipping points in the United States, 1906.[a]

Product hauled.	Number of counties reporting.	Average—					
		Miles to shipping point.	Days for round trip.	Pounds in one load.	Cost per load.	Cost per 100 pounds.	Cost per ton per mile.
Apples	114	9.6	0.9	2,300	$2.79	$0.12	$0.25
Barley	226	8.8	.7	3,970	2.67	.07	.16
Beans	22	9.0	.8	3,172	2.75	.09	.20
Buckwheat	8	8.2	.8	2,438	2.72	.11	.27
Corn	981	7.4	.6	2,696	1.78	.07	.19
Cotton	555	11.8	1.0	1,702	2.76	.16	.27
Cotton seed	110	10.7	.9	1,654	2.42	.15	.28
Flaxseed	51	10.4	.7	3,409	2.70	.08	.15
Fruit (except apples)	99	11.6	1.1	2,181	3.53	.16	.28
Hay	761	8.3	.7	2,786	2.32	.08	.19
Hemp	7	5.2	.7	3,393	2.10	.06	.23
Hogs (live)	316	7.9	.7	[b]1,941	2.00	[b].10	[b].25
Hops	14	11.7	1.0	3,665	3.89	.11	.19
Oats	798	7.3	.6	2,772	1.82	.07	.19
Peanuts	19	8.1	.6	1,363	1.67	.12	.30
Potatoes	569	8.2	.7	2,679	2.34	.09	.22
Rice	18	7.5	.8	2,407	2.70	.11	.29
Rye	78	8.4	.7	2,625	2.23	.08	.19
Timothy seed	5	8.0	.8	2,410	1.92	.08	.20
Tobacco	113	9.8	.8	2,248	2.28	.10	.20
Vegetables (except potatoes)	152	9.8	.9	1,852	2.84	.15	.31
Wheat	1,051	9.4	.8	3,323	2.86	.09	.19
Wool	41	39.8	5.6	4,869	21.39	.44	.22

a Figures for each product represent the average cost of hauling in only those States in which that product is marketed in considerable quantities.
b Average for 6 States only.

IMPORTS AND EXPORTS OF AGRICULTURAL PRODUCTS.[a]

Agricultural imports of the United States during the five years ending June 30, 1908.

Article imported.	1904.		1905.		1906.		1907.		1908.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER.										
Animals, live:										
Cattle—										
For breeding purposes, number	684	$79,986	2,314	$93,084	829	$118,368	835	$122,230	3,188	$149,142
Other ... do	15,372	230,751	25,541	365,488	28,190	430,062	31,567	442,892	89,168	1,358,168
Total cattle ... do	16,056	310,737	27,855	458,572	29,019	548,430	32,402	565,122	92,356	1,507,310
Horses—										
For breeding purposes ... do	2,634	1,090,596	2,853	1,169,011	3,377	1,266,987	3,644	1,574,020	3,562	1,325,784
Other ... do	2,092	369,691	2,327	422,072	2,644	449,688	2,436	404,085	1,925	278,608
Total horses ... do	4,726	1,460,287	5,180	1,591,083	6,021	1,716,675	6,080	1,978,105	5,487	1,604,392
Sheep—										
For breeding purposes ... do	1,253	23,298	2,200	45,319	2,679	53,951	3,081	67,555	5,609	104,509
Other ... do	236,841	791,991	184,742	659,402	238,068	966,408	221,717	1,052,870	219,156	978,097
Total sheep ... do	238,094	815,289	186,942	704,721	240,747	1,020,359	224,798	1,120,425	224,765	1,082,606
All other, including fowls	....	543,296	....	583,078	....	628,958	....	680,630	....	583,151
Total live animals	....	3,129,609	....	3,337,454	....	3,914,422	....	4,344,282	....	4,777,459
Beeswax ... pounds	425,168	116,878	373,569	101,121	587,617	168,014	917,088	264,637	671,526	194,769
Cochineal ... do	162,362	64,246	84,332	36,876	111,007	53,446	(b)	(b)	(b)	(b)
Dairy products:										
Butter ... do	154,457	31,761	593,101	124,136	196,642	57,955	441,755	117,835	780,608	182,897
Cheese ... do	22,707,103	3,284,811	23,095,705	3,379,600	27,286,866	4,303,830	33,848,766	5,704,012	32,530,830	5,586,706
Milk	....	32,931	....	23,014	....	10,858	....	10,188	....	11,496
Total dairy products	....	3,352,506	....	3,526,750	....	4,372,643	....	5,832,035	....	5,781,099
Eggs ... dozens	496,825	61,458	352,303	38,541	241,034	21,200	231,859	26,276	231,939	25,850
Egg yolks	....	22,781	....	37,036	....	10,992	....	10,616	....	10,845
Feathers and downs, crude	....	2,742,018	....	2,036,791	....	2,970,260	....	4,401,131	....	4,360,721

Fibers, animal:										
Silk—										
Cocoons ....pounds..	29,759	10,697	28,546	7,875	33,592	11,452	71,223	23,807	187	292
Raw, or as reeled from the cocoon ....pounds..	12,630,883	44,461,564	17,812,133	59,542,892	14,505,324	52,855,611	16,722,207	70,229,518	15,424,041	63,665,534
Waste ....do....	4,062,067	1,628,239	4,516,628	1,489,286	2,813,105	1,213,441	1,950,474	1,158,574	1,237,904	881,077
Total silk ....do....	16,722,709	46,100,500	22,357,307	61,040,053	17,352,021	54,080,504	18,743,904	71,411,899	16,662,132	64,546,903
Wool, and hair of the camel, goat, alpaca, and like animals—										
Class 1, clothing.......pounds..	45,575,993	8,573,494	109,888,258	24,762,682	86,810,307	20,936,934	82,982,116	21,378,304	45,798,303	10,278,199
Class 2, combing.........do....	12,934,143	2,819,822	26,551,624	6,521,171	15,204,254	4,214,024	10,671,378	3,235,281	13,332,540	3,624,617
Class 3, carpet............do....	115,232,698	13,420,275	112,695,864	14,941,705	99,674,107	13,917,414	110,194,051	16,920,443	66,849,681	9,762,122
Total wool ....do....	173,742,834	24,813,591	249,135,746	46,225,558	201,688,668	39,068,372	203,847,545	41,534,028	125,980,524	23,664,938
Total animal fibers.....do....	190,465,543	70,914,091	271,493,053	107,265,611	219,040,689	93,148,876	222,591,449	112,945,927	142,642,656	88,211,841
Glue ....do....	5,798,330	598,546	7,439,735	701,847	6,558,168	632,700	6,466,312	596,667	6,731,943	629,032
Honey ....gallons..	206,292	69,053	198,617	76,719	138,221	50,651	175,672	70,854	211,992	98,425
Packing-house products:										
Bladders, other than fish..........		19,578		15,837		23,915		11,835		4,905
Blood, dried...........................		23,671		11,064		24,277		94,023		40,023
Bones, hoofs, and horns............		536,366		926,505		1,013,351		845,255		733,798
Bristles—										
Crude, unsorted.......pounds..	11,241	10,976	8,122	4,054	13,435	9,389	11,620	5,325	7,710	7,620
Sorted, bunched, or prepared, pounds....................	2,576,615	2,356,325	2,461,464	2,366,444	2,728,114	2,686,357	3,433,941	3,256,552	2,614,783	2,090,157
Total bristles.....pounds..	2,587,856	2,367,301	2,469,586	2,370,498	2,741,549	2,695,746	3,445,561	3,261,877	2,622,493	2,097,777
Grease..................................		1,157,923		1,170,514		1,295,855		1,355,739		1,103,081
Gut.......................................		60,351		62,630		85,587		103,489		113,861
Hair......................................		2,639,586		3,328,471		3,704,987		3,038,996		2,770,658
Hide cuttings and other glue stock..		854,483		1,120,070		1,160,683		1,473,188		1,265,382
Hides and skins, other than furs—										
Cattle hides...........pounds..	85,370,168	10,989,035	113,177,357	14,949,628	156,155,300	21,862,060	134,671,020	20,649,258	98,353,249	12,044,435
Goatskins.................do....	86,338,547	23,971,731	97,803,571	26,945,721	111,079,391	31,773,909	101,201,596	31,715,298	63,640,758	17,325,126
Other.....................do....	103,024,752	17,045,304	126,893,934	22,868,797	158,045,419	30,246,198	135,111,199	30,841,989	120,770,918	25,400,575
Total hides and skins..do....	274,733,467	52,006,070	337,874,862	64,764,146	425,280,110	83,882,167	370,983,815	83,206,545	282,764,925	54,770,136

[a] Forest products come within the scope of the Department of Agriculture and are therefore included in alphabetical order in these tables.
[b] Not stated.

Agricultural imports of the United States during the five years ending June 30, 1908—Continued.

Article imported.	1904. Quantity.	1904. Value.	1905. Quantity.	1905. Value.	1906. Quantity.	1906. Value.	1907. Quantity.	1907. Value.	1908. Quantity.	1908. Value.
Packing-house products—Continued.										
Meat—										
Sausages, bologna		$121,143		$147,119	744,634	$149,593	451,059	$121,205	520,770	$108,367
Other, including meat extracts		814,341		674,441		675,568		888,209		775,713
Total meat		935,484		821,560		825,161		1,009,414		884,080
Oils ... gallons	171,544	34,830	175,620	27,559	160,854	23,914	132,843	26,671	85,964	16,965
Rennets		94,439		99,481		93,288		117,344		151,028
Sausage casings		885,645		836,323		874,293		1,288,922		2,182,036
Stearin ... pounds	1,492,407	110,606	2,800,540	191,960	1,700,177	134,196	1,184,287	93,385	1,434,845	135,739
Other		30,619		52,223		68,843		48,188		29,968
Total packing-house products		61,756,952		75,798,841		95,906,263		95,974,871		66,299,437
Total animal matter		142,828,138		192,957,587		201,249,467		224,467,296		170,389,478
VEGETABLE MATTER.										
Argols, or wine lees ... pounds	24,571,730	2,550,223	26,281,931	2,291,951	28,140,835	2,358,061	30,540,893	2,562,384	26,738,834	2,305,185
Breadstuffs. (*See* Grain and grain products.)										
Broom corn ... tons	6	392	3	918	1	777	4	1,663	2	516
Cider ... gallons	5,609	5,941	8,651	8,931	13,644	15,013	8,018	7,842	9,764	11,113
Cocoa and chocolate:										
Cocoa—										
Crude, and leaves and shells of ... pounds	72,277,600	8,873,709	73,815,895	8,577,649	80,117,402	8,697,515	92,249,819	13,376,562	82,831,242	14,257,250
Prepared, or manufactured pounds	1,009,082	300,409	874,878	259,037	1,055,031	299,141	1,267,733	371,816	1,016,990	311,661
Total cocoa ... pounds	73,286,682	9,174,118	74,690,773	8,836,686	81,172,433	8,996,656	93,517,552	13,748,378	83,848,232	14,568,911
Chocolate ... do	1,784,064	426,486	2,692,251	647,377	2,954,594	702,717	3,541,961	830,611	2,756,452	715,131
Total cocoa and chocolate, pounds	75,070,746	9,600,604	77,383,024	9,484,063	84,127,027	9,699,373	97,059,513	14,578,989	86,604,684	15,284,042
Coffee ... pounds	995,043,284	69,551,799	1,047,792,984	84,654,062	851,668,933	73,256,134	985,321,473	78,231,902	890,640,057	67,688,106

Coffee substitutes:										
Chicory root—										
Raw, unground..........do....	4,138,248	68,312	3,340,913	59,589	3,401,065	58,502	2,597,807	41,680	2,170,633	34,330
Roasted, ground, or otherwise prepared............pounds..	534,267	20,175	596,095	22,395	546,809	20,560	615,267	25,770	502,792	21,311
Total chicory root...do....	4,672,515	88,487	3,937,008	81,984	3,947,874	79,062	3,213,074	67,450	2,673,425	55,641
Other......................do....	462,378	26,483	244,327	15,407	439,227	28,705	341,486	23,385	431,603	27,621
Total coffee substitutes....do....	5,134,893	114,970	4,181,335	97,391	4,387,101	107,767	3,554,560	90,835	3,105,028	83,262
Curry and curry powder...............	....	9,955	....	8,327	....	10,424	....	14,983	....	14,350
Fibers, vegetable:										
Cotton....................pounds..	48,840,590	8,541,510	60,508,548	9,414,750	70,963,633	10,879,592	104,791,784	19,930,988	71,072,855	14,172,241
Flax.........................tons..	10,123	2,541,874	8,089	2,260,421	8,729	2,327,300	8,656	2,254,112	9,528	2,514,680
Hemp.......................do....	5,871	869,260	3,987	638,325	5,317	906,808	8,718	1,534,371	6,213	1,086,805
Istle, or Tampico fiber.......do....	13,622	1,199,014	15,607	1,405,184	13,914	1,283,311	14,966	1,369,206	10,174	893,273
Jute and jute butts..........do....	96,735	4,104,870	98,215	4,500,023	103,945	6,449,684	104,489	8,950,918	107,533	6,501,920
Manila hemp................do....	65,666	11,423,395	61,562	12,065,270	58,738	11,036,667	54,513	10,876,107	52,467	8,974,617
Sisal grass...................do....	109,214	15,935,555	100,301	15,256,859	98,037	15,282,208	99,061	14,959,415	103,994	14,047,369
Other.......................do....	14,428	1,740,317	17,149	1,991,989	18,603	2,074,312	22,580	2,295,229	13,575	1,471,419
Total vegetable fibers...........	....	46,355,795	....	47,532,821	....	50,239,882	....	62,170,346	....	49,665,324
Flowers, natural.......................	....	42,612	....	29,080	....	27,275	....	32,729	....	42,821
Forest products:										
Charcoal................bushels..	231,302	14,844	5,643	478	774,501	42,856	144,802	8,516	472,670	37,167
Cinchona bark............pounds..	3,605,131	501,375	4,251,869	570,725	4,076,553	383,726	3,515,958	380,552	3,983,825	368,419
Cork wood or cork bark..........	....	1,484,405	....	1,729,143	....	1,837,134	....	2,356,052	....	2,092,732
Dyewoods, and extracts of—										
Dyewoods—										
Logwood............tons..	48,491	663,572	35,514	444,824	37,313	496,551	38,230	478,636	21,594	244,460
Other.......................	....	588,934	....	77,751	....	109,515	....	54,902	....	55,940
Total dyewoods..........	....	1,252,506	....	522,575	....	606,066	....	533,538	....	300,400
Extracts and decoctions of, pounds.......................	3,145,770	269,777	3,436,642	299,036	3,390,316	290,179	4,796,655	379,927	3,959,049	238,649
Total dyewoods and extracts of.................	....	1,522,283	....	821,611	....	896,245	....	913,465	....	539,049

Agricultural imports of the United States during the five years ending June 30, 1908—Continued.

Article imported.	1904.		1905.		1906.		1907.		1908.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Forest products—Continued.										
Gums:										
Arabic .... pounds..	2,890,051	$186,623	3,651,544	$190,132	4,055,233	$232,715	7,068,066	$393,581	4,890,897	$348,883
Camphor, crude .... do....	2,819,673	874,665	1,904,002	638,744	1,668,744	608,440	3,138,070	1,572,863	2,814,299	1,365,269
Chicle .... do....	5,084,580	1,308,540	5,060,166	1,357,458	5,641,508	1,495,366	6,732,581	2,139,204	6,089,607	2,027,148
Copal, cowrie, and dammar, pounds	20,565,507	2,127,228	25,687,762	2,493,438	20,448,703	1,914,663	26,681,736	2,835,332	24,966,693	2,813,515
Gambier, or terra japonica, pounds	27,857,055	1,251,782	32,192,731	1,112,660	31,278,485	1,118,910	28,865,617	977,009	26,681,791	894,752
India rubber, gutta-percha, etc.—										
Balata .... pounds..	(a)	(a)	(a)	(a)	374,220	152,689	799,201	305,041	584,552	276,756
Guayule .... do....	(a)	(a)	(a)	(a)	(a)	(a)	1,187,596	24,613	1,524,401	28,583
Gutta-joolatong, or East Indian gum .... pounds..	14,887,416	430,231	19,104,911	641,319	21,390,116	733,074	28,437,660	1,085,098	22,803,303	1,039,776
Gutta-percha .... do....	424,617	174,953	665,217	210,188	500,770	188,161	546,890	201,339	188,610	100,305
India rubber .... do....	59,015,551	40,444,250	67,234,256	49,878,366	57,844,345	45,114,450	76,963,838	58,919,981	62,233,160	36,613,185
Total .... do....	74,327,584	41,049,434	87,004,384	50,729,873	80,109,451	46,188,374	107,935,185	60,536,072	87,334,026	38,058,605
Shellac .... do....	10,933,413	3,505,229	10,700,817	3,743,180	15,780,090	5,107,542	17,785,960	5,821,688	13,361,932	4,143,974
Other	....	917,815	....	1,094,869	....	1,423,088	....	1,234,479	....	939,952
Total gums	....	51,221,316	....	61,360,354	....	58,089,098	....	75,510,228	....	50,592,098
Ivory, vegetable .... pounds..	15,740,792	229,944	19,688,913	410,883	21,076,508	516,607	16,602,229	464,931	14,536,288	375,535
Naval stores—										
Tar and pitch (of wood), barrels	1,063	6,643	574	3,206	1,363	6,504	1,330	6,928	2,523	9,797
Turpentine, spirits of .. gallons..	19,751	6,224	43,063	13,546	158,730	59,273	35,386	16,110	76,743	29,210
Total naval stores	....	12,867	....	16,752	....	65,777	....	23,038	....	39,007
Palm leaf, natural	....	5,610	....	9,434	....	8,114	....	14,779	....	36,855
Tanning materials:										
Hemlock bark .... cords..	14,111	63,460	13,511	64,181	7,467	35,860	6,744	30,757	8,868	43,890
Mangrove bark .... tons..	(a)	(a)	(a)	(a)	(a)	(a)	20,693	426,431	15,192	310,745
Quebracho, extract of . pounds..	(a)	(a)	(a)	(a)	(a)	(a)	79,033,584	2,319,785	79,186,787	2,260,364
Quebracho wood .... tons..	(a)	(a)	(a)	(a)	(a)	(a)	66,810	840,779	48,871	612,971

Sumac, ground........pounds..	18,604,644	276,891	15,583,334	225,036	15,131,539	237,309	12,487,103	267,239	8,576,091	227,611
Other........................	....	194,201	....	923,949	....	1,419,962	....	84,406	....	125,378
Total tanning materials......	....	534,552	....	1,213,166	....	1,693,131	....	3,969,397	....	3,580,959
Wood, not elsewhere specified— Cabinet woods, unsawed— Mahogany.........M feet..	50,370	2,690,382	31,844	1,977,894	36,619	2,470,072	51,899	3,263,718	41,678	2,566,954
Other........................	....	1,434,229	....	1,077,723	....	1,334,748	....	2,091,882	....	1,464,907
Total cabinet woods......	....	4,124,611	....	3,055,617	....	3,804,820	....	5,355,600	....	4,031,861
Timber— Round, including logs, M feet..................	66,033	552,504	97,306	722,693	100,592	773,260	97,573	938,501	131,348	1,264,439
Hewn, squared, or sided, cubic feet................	139,180	33,357	184,742	28,912	256,180	46,770	(a)	(a)	(a)	(a)
Pulp wood ....cords..	(a)	(a)	(a)	(a)	(a)	(a)	650,366	2,792,751	923,503	4,989,919
Total timber............	....	585,861	....	751,605	....	820,030	....	3,731,252	....	6,254,358
Lumber— Boards, deals, planks, and other sawed lumber, M feet.....................	589,232	8,878,474	710,538	10,906,661	949,717	14,813,733	934,195	16,255,350	791,288	15,212,788
Shingles...............M..	770,373	1,602,999	758,725	1,581,421	900,856	1,852,612	881,003	1,940,001	988,081	2,379,242
Other........................	....	1,545,384	....	1,649,314	....	2,700,505	....	2,764,015	....	2,665,428
Total lumber............	....	12,026,857	....	14,137,396	....	19,366,850	....	20,959,366	....	20,257,458
All other......................	....	3,752,103	....	4,102,436	....	4,353,034	....	2,384,743	....	2,214,268
Total wood, n. e. s.......	....	20,489,432	....	22,047,054	....	28,344,734	....	32,430,961	....	32,757,945
Wood pulp.................tons..	144,796	3,602,668	167,504	4,500,955	157,224	4,584,942	213,110	6,348,857	237,514	7,313,326
Total forest products...........	....	79,619,296	....	92,680,555	....	96,462,364	....	122,420,776	....	97,733,092
Fruit juices, n. e. s.: Prune juice, or prune wine.gallons..	70,521	38,227	52,765	37,118	50,237	34,900	52,940	35,068	31,584	25,818
Other, including cherry juice.do....	62,988	27,731	23,574	14,130	40,893	24,661	54,553	35,662	40,467	26,677
Total fruit juices, n. e. s...do....	133,509	65,958	76,339	51,248	91,130	59,561	107,493	70,730	72,051	52,495
Fruits: Fresh or dried— Bananas............bunches..	(a)	7,709,976	(a)	9,897,821	(a)	10,330,302	(a)	11,883,168	37,003,388	11,391,211
Currants..............pounds..	38,347,649	997,430	31,742,919	764,289	37,078,311	1,119,146	38,392,779	1,746,941	38,652,656	1,592,018
Dates....................do....	21,058,164	463,459	19,257,250	360,483	22,435,672	479,142	31,270,899	850,558	24,958,343	689,190
Figs......................do....	13,178,061	660,360	13,364,107	617,027	17,562,358	722,967	24,346,173	1,136,924	18,836,574	867,523

a Not stated.

Agricultural imports of the United States during the five years ending June 30, 1908—Continued.

Article imported.	1904. Quantity.	1904. Value.	1905. Quantity.	1905. Value.	1906. Quantity.	1906. Value.	1907. Quantity.	1907. Value.	1908. Quantity.	1908. Value.
Fruits—Continued.										
Fresh or dried—Continued.										
Grapes.............cubic feet..	(a)	(a)	(a)	(a)	(a)	(a)	1,298,169	$1,575,521	2,231,508	$2,743,536
Lemons..............pounds..	171,923,221	$3,659,598	139,084,321	$2,905,082	138,717,252	$2,933,090	157,859,906	4,253,296	178,490,003	4,388,530
Olives...............gallons..	(a)	(a)	(a)	(a)	(a)	(a)	2,208,480	1,277,973	3,121,788	1,358,897
Oranges.............pounds..	35,893,260	525,468	28,880,575	374,088	31,134,341	456,726	21,267,316	351,495	18,397,429	275,060
Plums and prunes.......do....	494,105	46,976	671,604	63,617	497,494	53,348	323,377	45,386	235,089	49,322
Raisins.................do....	6,867,617	355,542	4,041,689	273,031	12,414,855	524,590	3,967,151	364,403	9,132,353	551,633
Other.....................	....	2,719,670	....	2,924,187	....	2,481,345	....	1,363,167	....	2,250,813
Total fresh or dried.........	....	17,168,479	....	18,179,625	....	19,104,556	....	24,851,832	....	26,160,553
Prepared or preserved............	....	1,796,209	....	1,599,488	....	2,437,766	....	1,272,445	....	1,550,246
Total fruits.............	....	18,964,688	....	19,779,113	....	21,542,322	....	26,124,277	....	27,710,799
Ginger, preserved or pickled...pounds..	230,890	13,502	436,051	24,874	365,255	19,516	472,190	29,810	409,331	27,189
Grain and grain products:										
Grain—										
Barley...............bushels..	90,708	45,245	81,020	39,546	18,049	9,803	38,319	14,033	199,741	143,407
Corn....................do....	16,633	10,837	15,443	10,623	10,127	8,458	10,818	8,357	20,312	15,536
Oats....................do....	170,882	57,802	38,773	18,626	22,675	10,726	71,552	26,634	364,307	179,714
Rye.....................do....	32,512	20,329	20,551	13,576	5	4	158	126	17	16
Wheat...................do....	6,852	7,517	3,102,585	2,769,317	57,995	53,291	375,433	237,049	341,617	329,766
Total grain............do....	317,587	141,730	3,258,372	2,851,688	108,851	82,282	499,280	286,179	925,994	668,439
Grain products—										
Macaroni, vermicelli, etc., pounds....................	40,224,202	1,617,634	53,411,080	2,083,833	77,926,029	2,941,204	87,720,730	3,479,824	97,232,708	4,009,995
Malt..................bushels..	3,465	3,250	3,298	3,580	2,458	2,711	3,362	3,917	2,675	3,090
Meal and flour—										
Oatmeal..........pounds..	235,819	14,201	304,668	16,361	312,306	16,625	301,266	15,581	341,003	19,876
Wheat flour.......barrels..	46,851	164,100	40,801	176,513	45,314	177,239	47,702	159,046	29,593	179,295
Total meal and flour.....	....	178,301	....	192,874	....	193,864	....	174,627	....	199,171
Other.....................	....	613,916	....	667,427	....	465,838	....	520,256	....	685,774
Total grain products.......	....	2,413,101	....	2,947,714	....	3,603,617	....	4,178,624	....	4,898,030
Total grain and grain products....................	....	2,554,831	....	5,799,402	....	3,685,899	....	4,461,803	....	5,566,469

Hay......tons..	114,388	914,842	46,214	359,515	68,540	502,051	61,116	501,507	10,063	89,808
Hops......pounds..	2,758,163	1,374,327	4,339,379	1,980,804	10,113,989	2,326,982	6,211,893	1,974,900	8,493,265	1,989,261
Indigo......do....	5,046,614	1,282,497	4,830,930	873,781	7,392,853	1,044,148	7,170,057	1,233,541	6,078,073	1,058,354
Licorice root......do....	89,463,182	1,472,323	108,443,892	1,780,109	102,151,969	1,661,454	66,115,863	1,140,541	109,355,720	1,864,436
Liquors, alcoholic:										
Distilled spirits—										
Of domestic manufacture, returned......proof gallons..	471,596	539,362	316,469	326,885	177,499	211,129	154,106	162,072	148,298	160,439
Brandy......do....	390,988	1,104,410	403,386	1,139,129	470,423	1,286,270	629,333	1,687,473	592,382	1,523,842
Other......do....	2,238,842	3,313,735	2,366,466	3,539,044	2,639,680	4,027,368	3,270,226	5,037,146	3,216,228	4,876,325
Total distilled spirits, proof gallons......	3,101,426	4,957,507	3,086,321	5,005,058	3,287,612	5,524,767	4,053,665	6,886,691	3,956,908	6,560,606
Malt liquors—										
Unbottled......gallons..	3,197,955	927,507	3,836,487	1,119,768	4,395,032	1,272,627	5,165,929	1,506,108	5,564,773	1,634,754
Bottled......do....	1,467,756	1,385,818	1,362,089	1,285,576	1,582,619	1,466,228	2,041,688	1,902,655	1,960,333	1,829,917
Total malt liquors......do....	4,665,711	2,313,325	5,198,576	2,405,344	5,977,651	2,738,855	7,207,617	3,408,763	7,525,106	3,464,671
Wines—										
Champagne and other sparkling......dozen quarts..	336,245	4,969,635	371,811	5,723,764	415,394	6,127,062	419,403	6,228,281	366,669	5,221,070
Still wines—										
Unbottled......gallons..	4,007,691	2,387,018	3,973,919	2,352,485	4,482,499	2,567,712	5,213,458	2,966,154	5,443,782	3,008,996
Bottled......dozen quarts..	471,153	2,035,217	488,773	2,165,672	546,688	2,299,194	636,938	2,614,346	628,428	2,516,461
Total still wines......	......	4,422,235	......	4,518,157	......	4,866,906	......	5,580,500	......	5,525,457
Total wines......	......	9,391,870	......	10,241,921	......	10,993,968	......	11,808,781	......	10,746,527
Total alcoholic liquors....	......	16,662,702	......	17,652,323	......	19,257,590	......	22,104,235	......	20,771,804
Malt, barley. (*See* Grain and grain products.)										
Malt extract, fluid or solid......	......	2,924	......	5,128	......	2,473	......	3,163	......	21,227
Malt liquors. (*See* Liquors, alcoholic.)										
Meal, cottonseed......pounds..	......	......	......	......	661,505	4,991	......	......	......	......
Nursery stock:										
Plants, trees, shrubs, vines, etc.....	......	1,493,789	......	1,510,435	......	1,599,052	......	1,841,206	......	2,003,973
Subtropical plants, etc., for propagation......	......	2,638	......	1,631	......	18,570	......	11,328	......	1,912
Total nursery stock......	......	1,496,427	......	1,512,066	......	1,617,622	......	1,852,534	......	2,005,885

a Not stated.

Agricultural imports of the United States during the five years ending June 30, 1908—Continued.

Article imported.	1904.		1905.		1906.		1907.		1908.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Nuts:										
Almonds................pounds..	9,838,852	$1,246,474	11,745,081	$1,520,063	15,009,326	$1,825,475	14,233,613	$2,331,816	17,144,968	$2,410,648
Cocoanuts........................	....	971,852	....	1,086,473	....	1,298,740	....	1,349,562	....	1,439,770
Cocoanut meat, broken, or copra, pounds........................	(a)	(a)	(a)	(a)	(a)	(a)	7,064,532	302,132	14,121,570	481,232
Cream and Brazil........bushels..	(a)	(a)	(a)	(a)	(a)	(a)	252,538	650,488	310,420	754,155
Palm, and palm nut kernels.......	....	(a)	....	(a)	....	(a)	....	38,962	....	2,277
Walnuts................pounds..	23,670,761	1,729,378	21,864,104	1,469,463	24,917,028	2,193,653	32,597,592	2,969,649	28,887,110	2,765,486
Other........................	....	1,523,462	....	2,082,344	....	2,055,557	....	2,100,274	....	1,790,375
Total nuts........................	....	5,471,166	....	6,158,343	....	7,373,425	....	9,742,883	....	9,643,943
Oil cake....................pounds..	1,794,873	18,592	1,129,013	12,968	5,454,941	54,144	512,654	5,342	2,848,291	27,513
Oils, vegetable:										
Fixed or expressed—										
Cocoanut oil..........pounds..	(a)	(a)	(a)	(a)	(a)	(a)	35,544,356	2,623,974	45,422,575	3,267,585
Nut oil, or oil of nuts, n. e. s., gallons........................	(a)	(a)	(a)	(a)	(a)	(a)	2,453,597	1,040,722	1,869,120	882,983
Olive, for mechanical purposes, gallons........................	(a)	(a)	(a)	(a)	2,538,366	1,105,876	1,471,766	682,656	1,565,253	703,829
Olive, salad..........gallons..	1,713,590	1,875,825	1,923,174	2,108,893	2,447,131	2,566,994	3,449,517	3,523,725	3,799,112	3,876,901
Palm oil..............pounds..	(a)	(a)	(a)	(a)	(a)	(a)	29,656,207	1,893,285	30,614,875	1,849,611
Other........................	....	5,952,702	....	6,010,432	....	6,015,403	....	1,925,300	....	1,788,150
Total fixed or expressed......	....	7,828,527	....	8,119,325	....	9,688,273	....	11,689,662	....	12,369,059
Volatile, or essential............	....	2,396,748	....	2,534,723	....	2,863,005	....	3,702,220	....	3,645,441
Total vegetable oils..........	....	10,225,275	....	10,654,048	....	12,551,278	....	15,391,882	....	16,014,500
Olive nuts, ground................	....	....	....	....	....	6,899	....	....	....	....
Opium, crude................pounds..	573,055	1,255,115	594,680	1,162,461	469,387	1,143,683	565,252	1,482,649	285,845	1,151,207
Rice, rice meal, etc.:										
Rice........................do....	75,323,157	1,869,338	43,408,509	1,097,099	58,468,791	1,465,487	71,287,151	2,118,147	87,619,202	2,543,417
Rice flour, rice meal, and broken rice....................pounds..	78,898,615	1,204,092	63,075,006	913,867	108,079,166	1,616,716	138,316,029	2,273,999	125,164,190	2,255,136
Total rice, etc..........do....	154,221,772	3,073,430	106,483,515	2,010,966	166,547,957	3,082,203	209,603,180	4,392,146	212,783,392	4,798,553
Sago, tapioca, etc..................	....	695,922	....	761,525	....	830,479	....	1,432,082	....	1,574,835

Seeds:										
Clover..................bushels..	(a)	(a)	(a)	(a)	(a)	(a)	22,849,115	2,385,734	20,659,396	2,323,699
Flaxseed, or linseed..........do....	213,270	201,224	296,184	318,687	52,240	73,423	90,356	124,494	57,419	71,625
Other........................	....	3,386,245	....	3,138,932	....	5,314,620	....	3,894,548	....	3,976,146
Total seeds.....................	....	3,587,469	....	3,457,619	....	5,388,043	....	6,404,776	....	6,371,470
Spices:										
Unground—										
Nutmegs..............pounds..	1,498,600	288,388	2,394,061	347,721	2,626,005	342,378	2,375,139	321,719	2,042,396	236,787
Pepper, black or white, pounds....................	18,615,186	2,069,051	19,413,387	1,969,521	26,535,834	2,733,137	24,320,865	2,232,774	20,335,693	1,532,901
Other...............pounds..	17,745,806	1,469,587	26,115,130	1,731,895	20,037,435	1,429,008	20,374,842	1,838,512	14,332,230	1,194,798
Total unground.......do....	37,859,592	3,827,026	47,922,578	4,049,137	49,199,274	4,504,523	47,070,846	4,393,005	36,710,319	2,964,486
Ground..................do....	5,414,804	538,982	5,106,179	534,219	7,047,685	683,593	6,490,048	719,995	5,414,493	627,051
Total spices..............do....	43,274,396	4,366,008	53,028,757	4,583,356	56,246,959	5,188,116	53,560,894	5,113,000	42,124,812	3,591,537
Spirits, distilled. (*See* Liquors, alcoholic.)										
Starch......................pounds..	7,430,383	191,450	6,140,753	180,465	5,422,267	156,176	6,330,493	152,020	5,284,050	138,166
Straw.........................tons..	10,838	81,794	2,825	12,700	4,317	16,539	1,497	6,147	1,462	7,659
Sugar and molasses:										
Molasses....................gallons..	18,828,530	1,018,198	19,477,885	1,137,844	16,021,076	690,718	24,630,935	919,806	18,882,756	721,867
Sugar—										
Raw—										
Beet.............pounds..	2,414,454	50,525	223,944,976	4,797,278	48,548,919	1,032,040	397,745,046	8,203,309	221,036,900	5,401,378
Cane...............do....	3,681,904,214	71,359,114	3,434,186,471	91,943,398	3,921,605,729	84,066,863	3,986,510,021	84,273,071	3,144,022,423	74,509,970
Total raw..........do....	3,684,318,668	71,409,639	3,658,131,447	96,740,676	3,970,154,648	85,098,903	4,384,255,067	92,476,380	3,365,059,323	79,911,348
Refined................do....	16,304,945	506,114	22,801,551	904,773	9,176,782	361,185	7,584,908	329,873	6,937,789	346,799
Total sugar...........do....	3,700,623,613	71,915,753	3,680,932,998	97,645,449	3,979,331,430	85,460,088	4,391,839,975	92,806,253	3,371,997,112	80,258,147
Total sugar and molasses....	....	72,933,951	....	98,783,293	....	86,150,806	....	93,726,059	....	80,980,014
Tea........................pounds..	112,905,541	18,229,310	102,706,599	16,230,858	93,621,750	14,580,878	86,368,490	13,915,544	94,149,564	16,309,870
Teazels........................	....	....	....	....	....	10,169	....	9,756	....	10,509
Tobacco:										
Wrapper................pounds..	7,387,390	5,641,124	7,109,595	5,270,032	6,732,774	6,475,226	7,576,325	8,617,575	5,943,714	6,312,023
Filler and other leaf..........do....	23,775,246	11,298,363	26,178,783	12,768,645	30,622,703	15,972,288	31,963,996	17,437,673	26,112,329	16,558,305
Stems.......................do....	(a)	(a)	(a)	(a)	3,770,493	15,954	1,358,486	4,737	2,949,088	14,203
Total tobacco.............do....	31,162,636	16,939,487	33,288,378	18,038,677	41,125,970	22,463,468	40,898,807	26,059,985	35,005,131	22,884,531

a Not stated.

Agricultural imports of the United States during the five years ending June 30, 1908—Continued.

Article imported.	1904.		1905.		1906.		1907.		1908.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Vanilla beans..................pounds..	550,328	$1,424,647	608,116	$871,442	852,505	$1,321,550	969,249	$1,523,156	571,977	$1,170,135
Vegetables:										
Fresh or dried—										
Beans and dried pease.bushels..	978,187	1,223,309	472,572	628,775	458,041	667,214	406,679	656,898	1,657,401	2,406,935
Onions..................do....	1,171,242	914,413	856,366	643,207	872,566	615,584	1,126,114	926,115	1,275,333	866,663
Potatoes..................do....	3,166,581	1,870,004	181,199	168,094	1,948,160	853,063	176,917	192,635	403,952	283,032
Other........................	....	780,761	....	646,736	....	815,068	....	1,024,262	....	1,138,429
Total fresh or dried..........	....	4,788,487	....	2,086,812	....	2,950,929	....	2,799,910	....	4,695,059
Prepared or preserved—										
Pickles and sauces............	....	646,858	....	578,489	....	706,050	....	934,803	....	816,245
Other........................	....	1,573,257	....	1,317,971	....	1,435,953	....	1,993,759	....	2,777,764
Total prepared or preserved..	....	2,220,115	....	1,896,460	....	2,142,003	....	2,928,562	....	3,594,009
Total vegetables..............	....	7,008,602	....	3,983,272	....	5,092,932	....	5,728,472	....	8,289,068
Vinegar......................gallons..	181,294	46,856	191,768	46,434	198,591	49,319	230,072	65,282	204,213	56,671
Wafers, unmedicated..................	....	20,327	....	19,293	....	26,353	....	26,617	....	28,016
Wines. (*See* Liquors alcoholic.)										
Total vegetable matter, including forest products..............	....	398,226,009	....	453,574,182	....	449,388,139	....	524,790,288	....	467,033,735
Total vegetable matter, excluding forest products............	....	318,606,713	....	360,893,627	....	352,925,775	....	402,369,512	....	369,300,643
Total agricultural imports, including forest products.........	....	541,054,147	....	646,531,769	....	650,637,606	....	749,257,584	....	637,423,213
Total agricultural imports, excluding forest products.........	....	461,434,851	....	553,851,214	....	554,175,242	....	626,836,808	....	539,690,121

Agricultural exports (domestic) of the United States during the five years ending June 30, 1908.

Article exported.	1904.		1905.		1906.		1907.		1908.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER.										
Animals, live:										
Cattle....number..	593,409	$42,256,291	567,806	$40,598,018	584,239	$42,081,170	423,051	$34,577,392	349,210	$29,339,134
Fowls	....	(a)	....	(a)	....	(a)	....	(a)	....	151,925
Horses....number..	42,001	3,189,100	34,822	3,175,259	40,087	1,365,981	33,882	4,359,957	19,000	2,612,587
Mules....do....	3,658	412,971	5,826	615,464	7,167	989,639	6,781	850,901	6,609	990,667
Sheep....do....	301,313	1,954,604	268,365	1,687,321	142,690	801,090	135,344	750,242	101,000	589,285
Swine....do....	6,345	53,780	44,496	416,692	59,170	630,998	21,262	399,440	30,818	307,202
Other [b]	....	111,129	....	205,497	....	267,690	....	355,148	....	110,489
Total live animals....	....	47,977,875	....	40,728,281	....	49,129,568	....	41,203,080	....	34,101,289
Beeswax....pounds..	55,631	16,545	85,406	24,966	101,726	29,894	117,169	36,392	90,506	28,659
Dairy products:										
Butter....do....	10,717,824	1,768,184	10,071,487	1,648,281	27,360,537	4,922,013	12,541,777	2,429,489	6,463,061	1,407,962
Cheese....do....	23,335,172	2,452,239	10,134,424	1,084,044	16,562,451	1,940,620	17,285,230	2,012,626	8,439,031	1,092,053
Milk....	....	1,367,794	....	2,156,616	....	1,889,690	....	2,191,111	....	2,455,186
Total dairy products....	....	5,588,217	....	4,888,911	....	8,752,323	....	6,633,226	....	4,955,201
Eggs....dozens..	1,776,632	396,408	2,175,884	543,386	4,952,063	1,038,679	6,968,985	1,542,789	7,590,977	1,540,014
Egg yolks....	....	28,294	....	917	....	51,851	....	11,565	....	9,024
Feathers....	....	157,035	....	239,256	....	263,377	....	316,306	....	389,556
Fibers, animal:										
Silk waste....pounds..	227,139	30,814	72,451	9,806	71,368	13,781	129,078	37,709	198,736	49,881
Wool....do....	319,750	37,171	123,951	15,068	192,481	29,095	214,840	48,820	182,458	42,104
Total animal fibers....do....	546,889	67,985	196,402	24,874	263,849	42,876	343,918	86,529	381,194	91,985
Glue....do....	2,656,057	258,511	2,821,202	279,534	3,157,537	298,796	3,181,715	331,998	2,917,173	289,441
Honey....	....	69,317	....	63,367	....	111,935	....	93,690	....	78,102

a Not stated.

b Including "Fowls" prior to July 1, 1907.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1908—Continued.

Article exported.	1904.		1905.		1906.		1907.		1908.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Packing-house products:										
Beef—										
Canned............pounds..	57,468,338	$5,882,888	66,688,568	$6,588,958	64,523,359	$6,430,446	15,809,826	$1,615,808	23,376,447	$2,467,875
Cured—										
Salted or pickled..do....	57,584,710	3,260,475	55,934,705	3,095,304	81,088,098	4,697,742	62,645,281	3,740,212	46,958,367	3,213,480
Other.............do....	269,112	20,542	136,476	14,057	199,483	22,063	1,053,287	107,956	937,720	106,470
Total cured......do....	57,853,822	3,281,017	56,071,181	3,109,361	81,287,581	4,719,805	63,698,568	3,848,168	47,896,087	3,319,950
Fresh.................do....	299,579,671	26,841,586	236,486,568	22,138,365	268,054,227	24,310,038	281,651,502	26,367,287	201,154,105	20,339,377
Oils—Oleo oil and neutral lard..............pounds..	165,183,839	12,873,558	145,228,245	11,485,145	209,658,075	17,455,976	195,337,176	16,819,933	212,541,157	19,278,476
Oleomargarin..........do....	6,137,251	605,874	7,863,164	711,038	11,794,174	1,033,256	5,397,609	520,406	2,938,175	299,746
Tallow................do....	76,924,174	3,801,302	63,536,992	3,022,173	97,567,156	4,791,025	127,857,739	7,182,688	91,397,507	5,399,219
Total beef..........do....	663,147,095	53,286,225	575,874,718	47,055,040	732,884,572	58,740,546	689,752,420	56,354,290	579,303,478	51,104,643
Bones, hoofs, horns, and horn tips, strips and waste..............	....	208,523	....	181,203	....	212,516	....	172,208	....	245,628
Bristles..........................	....	1,808	....	1,497	....	329	....	2,732	....	410
Grease, grease scraps, and all soap stock..........................	....	3,311,777	....	3,710,907	....	4,138,333	....	5,473,623	....	5,762,709
Hair..............................	....	724,514	....	778,471	....	854,038	....	938,433	....	1,165,475
Hides and skins, other than furs..................pounds..	32,727,643	3,246,887	10,268,722	1,051,641	10,752,827	1,223,255	15,396,806	1,760,032	14,650,454	1,536,225
Lard compounds..........do....	53,603,545	3,581,813	61,215,187	3,613,235	67,621,310	4,154,183	80,148,861	6,166,910	75,183,210	6,035,418
Meat, canned, n. e. s............	....	2,254,235	....	1,974,693	....	1,593,497	....	745,247	....	1,265,283
Mutton.................pounds..	465,255	40,618	640,837	52,503	516,345	51,163	822,998	83,874	1,185,040	117,688
Oils, animal, n. e. s.....gallons..	452,481	273,481	377,777	217,596	338,687	224,991	503,234	292,381	621,300	341,304
Pork—										
Canned............pounds..	9,479,312	963,321	10,254,239	993,394	12,699,800	1,215,857	2,710,369	287,460	4,957,022	532,442
Cured—										
Bacon.............do....	249,665,941	24,446,752	262,246,635	25,428,961	361,210,563	35,845,793	250,418,699	26,470,972	241,189,929	25,481,246
Hams..............do....	194,948,864	22,293,867	203,458,724	21,562,204	194,267,949	20,075,511	209,481,496	23,698,207	221,769,634	25,167,059
Salted or pickled..do....	112,224,861	9,527,388	118,887,189	9,412,034	141,820,720	11,681,634	166,427,409	15,167,058	149,505,937	13,332,654
Total cured......do....	556,839,666	56,268,007	584,592,548	56,403,199	697,299,232	67,602,938	626,327,604	65,336,237	612,465,500	63,980,959

Fresh ....do....	18,633,820	1,669,818	14,946,284	1,291,794	13,444,438	1,261,412	11,467,779	1,143,886	16,374,468	1,551,450
Lard ....do....	561,302,643	46,347,520	610,238,899	47,243,181	741,516,886	60,132,091	627,559,660	57,497,980	603,413,770	54,789,748
Oils—Lard oil ......gallons..	376,826	244,499	260,797	154,409	298,103	180,474	234,730	144,063	259,062	169,625
Total pork	....	105,493,165	....	106,085,977	....	130,392,772	....	124,409,626	....	121,024,224
Sausage and sausage meat, pounds	5,562,349	602,528	6,061,508	671,241	7,926,786	881,686	8,000,973	925,877	8,367,495	969,472
Sausage casings	....	2,353,167	....	2,646,868	....	2,572,479	....	3,422,271	....	3,959,384
All other	....	2,062,813	....	2.267,359	....	2,633,986	....	2,708,632	....	2,659,228
Total packing-house products..	....	177,441,554	....	170,308,231	....	207,673,774	....	203,456,136	....	196,187,091
Poultry and game	....	1,009,304	....	897,425	....	1,397,004	....	1,086,618	....	881,792
Quills	....	23,164	....	1,618	....	150	....	....	....	....
Silk waste. (*See* Fibers, animal).										
Wool. (*See* Fibers, animal.)										
Total animal matter	....	233,034,209	....	224,000,796	....	268,804,107	....	254,798,329	....	238,552,154
VEGETABLE MATTER.										
Breadstuffs. (*See* Grain and grain products.)										
Broom corn	....	226,179	....	227,066	....	240,164	....	268,812	....	266,696
Cider ....gallons.	714,476	103,314	394,723	61,204	344,117	53,577	197,514	30,681	172,617	26,401
Cocoa, ground or prepared, and chocolate	....	250,084	....	279,819	....	349,107	....	376,467	....	403,509
Coffee:										
Green or raw ....pounds..	32,208,497	3,656,943	15,559,235	1,966,107	28,346,323	3,483,238	38,771,906	4,692,137	35,356,109	4,314,020
Roasted or prepared ......do....	405,893	64,516	550,016	82,451	838,181	117,749	2,261,517	297,280	4,301,029	474,451
Total ....do..	32,614,390	3,721,459	16,109,251	2,048,558	29,184,504	3,600,987	41,033,423	4,989,417	39,657,138	4,788,471
Cotton:										
Sea Island ....bales....	34,776	3,154,376	42,721	3,365,448	42,271	3,335,022	20,173	2,075,446	33,042	3,351,132
Sea Island ....pounds..	13,254,404		16,653,124		16,245,924		7,605,804		12,699,567	
Upland ....bales....	5,974,418	367,656,870	8,295,243	376,599,566	a 7,008,085	a 397,670,899	a 8,688,296	a 479,202,351	a 7,401,538	a 434,437,070
Upland ....pounds..	3,049,938,356		4,288,195,779		a 3,617,799,246		a 4,510,611,416		a 3,804,299,126	
Linters ....do....	26,663,146	1,238,018	34,473,174	1,433,925	(b)	(b)	(b)	(b)	(b)	(b)
Total ....do....	3,089,855,906	372,049,264	4,339,322,077	381,398,939	3,634,045,170	401,005,921	4,518,217,220	481,277,797	3,816,998,693	437,788,202
Flavoring extracts and fruit juices....	....	....	....	....	....	52,490	....	48,491	....	52,395
Flowers, cut	....	5,076	....	4,522	....	3,496	....	2,579	....	1,784

a Including linters.

b Included in "Upland."

Agricultural exports (domestic) of the United States during the five years ending June 30, 1908—Continued.

Article exported.	1904.		1905.		1906.		1907.		1908.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Forest products:										
Bark, and extract of, for tanning—										
Bark..................pounds..	(a)	(a)	(a)	(a)	4,873,237	$75,084	2,322,130	$29,975	3,987,330	$57,515
Bark, extracts of...............	....	(a)	....	(a)	....	356,847	....	305,998	....	241,608
Total..........................	....	$291,783	....	$552,909	....	431,931	....	335,973	....	299,123
Charcoal...........................	....	22,646	....	23,479	....	14,727	....	7,956	....	4,271
Moss................................	....	(a)	....	(a)	....	37,201	....	40,578	....	33,742
Naval stores—										
Rosin.................barrels..	2,585,108	6,621,870	2,310,275	7,069,084	2,438,556	9,899,080	2,560,966	11,327,091	2,712,732	11,395,126
Tar.....................do....	15,644	44,944	20,291	60,520	16,821	55,362	16,792	57,215	14,691	53,983
Turpentine and pitch....do....	13,177	32,253	24,971	74,938	14,232	43,875	19,830	60,563	13,448	46,339
Turpentine, spirits of..gallons..	17,202,808	9,446,155	15,894,813	8,902,101	15,981,253	10,077,268	15,854,676	10,241,883	19,532,583	10,146,151
Total..........................	....	16,145,222	....	16,106,643	....	20,075,585	....	21,686,752	....	21,641,599
Wood—										
Timber—										
Round..........................	....	4,473,297	....	3,040,846	....	3,866,300	....	3,645,180	....	4,337,766
Hewn..........cubic feet..	3,788,740	881,557	3,856,623	913,654	3,517,046	877,786	3,278,110	896,106	4,883,506	1,316,465
Sawed.............M feet..	558,690	8,472,355	486,411	7,294,168	552,548	10,649,310	600,865	13,101,178	463,440	11,040,677
Total timber............	....	13,827,209	....	11,248,668	....	15,393,396	....	17,636,464	....	16,694,908
Lumber—										
Boards, deals, and planks, M feet..................	1,426,784	28,603,355	1,283,406	24,483,214	1,344,607	28,695,823	1,623,964	39,861,352	1,548,130	35,607,508
Joists and scantling, M feet.....................	60,119	875,062	47,309	704,305	29,119	501,711	34,851	752,152	27,332	581,718
Shingles..............M..	28,484	82,377	24,345	69,251	26,272	73,635	18,256	53,261	20,483	75,535
Shooks—										
Box..........................	....	869,802	....	825,145	....	954,268	....	939,724	....	958,127
Other........number..	533,182	795,595	872,192	1,278,972	1,066,253	1,524,549	803,346	1,409,595	900,812	1,716,190
Total shooks........	....	1,665,397	....	2,104,117	....	2,478,817	....	2,349,319	....	2,674,317
Staves and heading—										
Heading...............	....	170,874	....	148,042	....	201,219	....	157,553	....	176,430
Staves.......number..	47,420,095	4,032,344	48,286,285	3,613,635	57,586,378	4,699,877	51,120,171	5,127,522	61,696,949	6,016,690

Total staves and heading	....	4,203,218	....	3,761,677	....	4,901,096	....	5,285 075	....	6,193,120
Other	....	3,190,687	....	3,068,115	....	3,317,164	....	3,578,452	....	5,216,854
Total lumber	....	38,620,096	....	34,190,679	....	39,968,246	....	51,879,611	....	50,349,052
Total wood	....	52,447,305	....	45,439,347	....	55,361,642	....	69,516,075	....	67,043,960
Wood alcohol....proof galls.	1,194,466	585,359	1,097,451	603,385	780,222	466,467	2,150,311	862,819	1,958,630	819,753
Wood pulp....pounds	30,230,820	593,474	23,703,906	473,585	29,482,434	587,878	25,079,946	498,552	23,845,732	519,625
Total forest products	....	70,085,789	....	63,199,348	....	76,975,431	....	92,948,705	....	90,362,073
Fruits:										
Fresh or dried—										
Apples, dried....pounds	48,301,665	2,791,421	39,272,890	2,208,414	27,852,831	2,044,820	45,697,948	3,166,916	24,237,873	1,946,810
Apples, fresh....barrels	2,018,262	5,446,473	1,499,942	3,859,375	1,208,989	3,751,375	1,539,267	4,652,966	1,049,545	3,660,854
Apricots, dried....pounds	7,205,686	608,511	6,854,154	606,777	13,760,281	1,325,422	2,760,432	336,812	1,224,602	239,467
Oranges....boxes	(a)	739,593	(a)	929,151	(a)	1,110,993	(a)	1,255,104	654,251	1,577,661
Peaches, dried....pounds	(a)	(a)	(a)	(a)	1,181,649	110,407	1,757,650	186,013	1,148,598	144,318
Pears, fresh	....	(a)	....	(a)	....	631,972	....	675,914	....	288,918
Prunes....pounds	73,146,214	3,410,497	54,993,849	2,455,056	24,869,744	1,410,636	44,400,104	2,400,969	28,148,450	1,642,114
Raisins....do	4,020,418	281,402	7,054,824	372,087	4,528,502	305,768	9,128,827	509,368	5,684,541	427,583
Other	....	4,317,910	....	2,253,638	....	1,727,943	....	2,246,384	....	2,360,360
Total fresh or dried	....	17,595,807	....	12,684,498	....	12,419,336	....	15,520,557	....	12,278,085
Preserved—										
Canned	....	2,637,002	....	2,541,025	....	2,348,064	....	1,581,047	....	1,549,826
Other	....	115,490	....	71,868	....	89,872	....	104,663	....	137,929
Total preserved	....	2,752,492	....	2,612,893	....	2,437,936	....	1,685,710	....	1,687,755
Total fruits	....	20,348,299	....	15,297,391	....	14,857,272	....	17,206,267	....	13,965,840
Ginseng....pounds	131,882	851,820	146,576	1,069,849	160,949	1,175,844	117,696	813,023	154,180	1,111,994
Glucose and grape sugar:										
Glucose....do	152,768,716	2,949,545	175,250,580	3,206,794	189,656,011	3,489,192	151,629,441	3,017,527	98,608,192	1,898,652
Grape sugar....do									31,078,642	641,988
Grain and grain products:										
Grain—										
Barley....bushels	10,881,627	6,292,914	10,661,655	5,585,544	17,729,360	8,653,231	8,238,842	4,556,295	4,349,078	3,205,528
Buckwheat....do	31,006	19,827	316,399	209,941	696,513	449,129	199,429	128,837	116,127	94,638
Corn (maize)....do	55,858,965	30,071,334	88,807,223	47,446,921	117,718,657	62,061,856	83,300,708	44,261,816	52,445,800	33,942,197
Oats....do	1,153,714	475,362	5,479,308	2,085,992	46,324,935	16,234,918	4,014,042	1,670,881	1,158,622	624,569

a Not stated.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1908—Continued.

Article exported.	1904.		1905.		1906.		1907.		1908.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Grain and grain products—Continued.										
Grain—Continued.										
Rye..........bushels..	765,108	$440,980	1,423	$1,191	1,355,528	$905,350	749,455	$562,016	2,419,958	$2,184,335
Wheat..........do....	44,230,169	35,850,318	4,394,402	3,905,579	34,973,291	28,757,517	76,569,423	60,214,388	100,371,057	99,736,767
Total grain..........do....	112,920,589	73,150,735	109,660,410	59,235,168	218,798,284	117,062,001	173,071,899	111,394,233	160,860,642	139,788,034
Grain products—										
Bran, middlings, and mill feed, tons..........	19,193	366,213	36,293	722,582	99,418	2,052,285	92,675	2,115,848	116,917	3,004,174
Breadstuff preparations—										
Bread and biscuit..pounds..	12,071,261	635,133	11,887,843	645,909	11,193,643	660,252	11,886,745	696,025	13,052,074	766,170
Other..........	....	2,172,571	....	2,064,790	....	2,208,585	....	1,942,238	....	1,885,915
Total breadstuff preparations..........	....	2,807,704	....	2,710,699	....	2,868,837	....	2,638,263	....	2,652,085
Distillers' and brewers' grains and malt sprouts.......tons..	56,038	1,062,336	75,549	1,485,671	102,683	1,937,315	84,581	1,617,850	65,682	1,424,677
Malt..........bushels..	438,580	315,676	487,158	342,851	881,523	598,453	414,515	278,448	224,991	201,554
Meal and flour—										
Corn meal..........barrels..	590,774	1,691,669	371,565	1,113,295	543,794	1,623,397	766,880	2,313,410	654,515	2,053,447
Oatmeal..........pounds..	14,526,477	463,062	52,476,917	1,123,712	37,972,903	948,088	42,701,257	1,122,162	24,484,199	705,853
Rye flour..........barrels..	3,160	11,302	4,721	19,618	5,383	20,019	3,377	10,879	4,105	16,521
Wheat flour..........do....	16,999,432	68,894,836	8,826,335	40,176,136	13,919,048	59,106,869	15,584,667	62,175,397	13,927,247	64,170,508
Total meal and flour.....	....	71,060,869	....	42,732,791	....	61,608,373	....	65,621,848	....	66,946,329
All other..........	....	602,521	....	845,999	....	850,090	....	732,660	....	1,445,289
Total grain products..........	....	76,215,319	....	48,840,593	....	70,005,353	....	73,004,917	....	75,674,108
Total grain and grain products..........	....	149,366,054	....	108,075,761	....	187,067,354	....	184,399,150	....	215,462,142
Grasses, dried..........	....	8,762	....	11,138	....	9,805	....	11,670	....	1,206
Hay..........tons..	60,730	1,052,705	66,557	1,080,505	70,172	1,116,307	58,602	976,287	77,281	1,463,010
Hops..........pounds..	10,985,988	2,116,180	11,858,612	4,480,666	13,026,904	3,125,843	16,809,534	3,531,972	22,920,480	2,963,167
Lard compounds. (*See* Meat and meat products.)										

Liquors, alcoholic:										
Distilled spirits—										
Alcohol, including cologne spirits.........proof gallons..	587,549	112,299	1,081,871	223,664	504,665	103,833	428,107	70,814	235,752	53,793
Brandy..................do....	70,193	44,111	21,171	18,217	5,145	8,553	14,172	22,496	2,750	4,900
Rum.....................do....	757,227	994,959	911,371	1,175,837	701,423	877,922	914,074	1,191,418	938,331	1,232,179
Whisky—										
Bourbon.............do....	231,540	254,693	212,001	246,115	183,621	245,264	190,067	253,222	129,258	160,914
Rye.................do....	127,535	217,551	106,893	207,606	109,522	207,783	134,110	252,918	172,755	320,935
Total whisky......do....	359,075	472,244	318,894	453,721	293,143	453,047	324,177	506,140	302,013	481,849
Other..................do....	47,402	67,854	83,771	97,328	40,089	81,870	19,779	36,889	28,391	43,566
Total distilled spirits...do....	1,821,446	1,691,467	2,417,078	1,968,767	1,544,465	1,525,225	1,700,309	1,827,757	1,507,237	1,816,287
Malt liquors—										
Unbottled.............gallons..	382,346	84,687	354,097	80,436	256,575	57,192	356,788	87,114	272,949	55,965
Bottled.........dozen quarts..	540,301	769,432	626,400	932,372	727,731	1,059,584	743,163	1,128,226	643,230	964,207
Total malt liquors...........	....	854,119	....	1,012,808	....	1,116,776	....	1,215,340	....	1,020,172
Wines—										
Unbottled.............gallons..	896,643	403,557	839,386	355,215	789,526	326,335	560,147	251,353	438,676	195,160
Bottled.........dozen quarts..	6,066	33,136	5,800	28,242	5,596	25,215	4,404	20,128	6,273	30,830
Total wines..................	....	436,693	....	383,457	....	351,550	....	271,481	....	225,990
Total alcoholic liquors.......	....	2,982,279	....	3,365,032	....	2,993,551	....	3,314,578	....	3,062,449
Malt. (*See* Grain and grain products.)										
Malt liquors. (*See* Liquors, alcoholic.)										
Malt sprouts. (*See* Grain and grain products.)										
Nursery stock.........................	....	287,880	....	219,223	....	242,056	....	225,339	....	247,844
Nuts:										
Peanuts..................pounds..	(a)	(a)	(a)	(a)	7,180,163	275,927	6,386,012	278,236	5,503,685	283,819
Other..............................	....	(a)	....	(a)	....	140,959	....	103,929	....	89,205
Total nuts.........................	....	330,366	....	309,195	....	416,886	....	382,165	....	373,024
Oil cake and oil-cake meal:										
Corn......................pounds..	14,014,885	169,921	24,171,127	278,526	48,420,942	605,346	56,808,972	677,156	66,127,704	801,787
Cottonseed..................do....	820,349,073	9,134,088	1,251,907,996	13,837,178	1,110,834,678	13,073,100	1,340,967,136	17,062,594	929,287,467	11,889,415
Flaxseed, or linseed.........do....	668,868,722	7,765,169	618,498,525	7,600,907	758,916,364	10,313,118	665,936,164	8,675,877	696,135,362	9,175,559
Total..............................	1,503,232,680	17,069,178	1,894,577,648	21,776,611	1,918,171,984	23,991,564	2,063,712,272	26,415,627	1,691,550,533	21,866,761

a Not stated.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1908—Continued.

Article exported.	1904.		1905.		1906.		1907.		1908.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Oils, vegetable:										
Fixed or expressed—										
Corn.................gallons..	3,222,875	$998,613	3,108,917	$890,937	3,833,251	$1,172,206	3,041,269	$1,083,929	3,659,330	$1,456,120
Cottonseed..............do....	29,013,743	10,717,280	51,535,580	15,125,802	43,793,519	13,673,370	41,880,304	17,074,403	41,019,991	17,226,451
Linseed.................do....	336,419	147,721	282,188	125,354	312,766	150,395	450,208	203,712	367,883	172,083
Other..........................	....	189,451	....	139,219	....	244,267	....	430,965	....	206,993
Total fixed or expressed......	....	12,053,065	....	16,281,312	....	15,240,238	....	18,793,009	....	19,061,647
Volatile, or essential—										
Peppermint..........pounds..	42,939	124,728	36,953	135,060	74,151	206,261	147,722	499,082	141,617	357,555
Other..........................	....	440,588	....	215,860	....	459,532	....	258,423	....	214,765
Total volatile, or essential....	....	565,316	....	350,920	....	665,793	....	757,505	....	572,320
Total vegetable oils..........	....	12,618,381	....	16,632,232	....	15,906,031	....	19,550,514	....	19,633,967
Rice, rice meal, etc.:										
Rice....................pounds..	2,380,418	88,465	74,866,965	2,254,446	3,969,722	138,853	2,443,008	84,681	2,195,947	87,687
Rice bran, meal, and polish, pounds..........................	26,741,345	200,263	38,415,795	266,891	34,172,331	255,265	27,731,363	259,521	26,248,468	236,070
Rice hulls........................	....	....	....	....	....	101,754	....	113,071	....	150,011
Total................pounds..	29,121,763	288,728	113,282,760	2,521,337	....	495,872	....	457,273	....	473,768
Root beer...............dozen quarts..	456	455	332	358	3,276	3,615	1,756	1,846	330	441
Roots, herbs, and barks, n. e. s.........	....	266,809	....	339,083	....	364,411	....	413,799	....	435,041
Seeds:										
Cotton ....pounds..	12,859,756	141,174	21,101,129	235,833	23,717,326	268,330	17,628,111	209,493	28,478,473	353,213
Flaxseed, or linseed.......bushels..	758,379	820,668	1,338	1,738	5,988,519	7,495,748	6,336,310	7,990,383	4,277,313	5,721,337
Grass seed—										
Clover.................pounds..	6,440,618	600,626	10,657,365	1,114,015	2,265,760	267,258	3,989,798	420,104	3,547,747	579,199
Timothy.................do....	12,672,676	480,946	16,141,269	584,618	11,247,080	385,454	18,616,834	813,224	25,550,134	1,247,960
Other..........................	....	299,649	....	303,989	....	217,995	....	397,493	....	495,245
Total grass seed............	....	1,381,221	....	2,002,622	....	870,707	....	1,630,821	....	2,322,404
All other seeds..................	....	240,262	....	317,554	....	277,877	....	263,912	....	286,734
Total seeds......................	....	2,583,325	....	2,557,747	....	8,912,662	....	10,094,609	....	8,683,688
Spices..................................	....	28,521	....	32,372	....	66,970	....	50,111	....	43,587
Spirits, distilled. (*See* Liquors, alcoholic.)										

Starch.....pounds..	57,185,739	1,340,282	61,450,444	1,430,572	66,574,881	1,490,797	51,334,580	1,126,465	48,125,851	1,142,054
Straw	.....	4,607	.....	7,342	.....	7,381	.....	7,482	.....	6,552
Sugar, molasses, and sirup:										
Molasses.....gallons..	3,819,139	592,288	4,384,863	591,879	10,205,885	977,097	3,193,322	297,493	3,320,419	425,757
Sirup.....do....	12,901,957	1,846,563	13,337,423	2,076,200	12,335,645	1,975,856	14,115,819	2,050,964	13,181,095	1,961,670
Sugar—										
Raw.....pounds..	113,977	3,427	25,099	969	276,556	7,797	58,587	1,812	13,285	523
Refined.....do....	15,304,560	528,616	18,322,978	745,639	21,899,290	823,221	21,179,016	829,350	25,497,358	973,661
Total sugar.....do....	15,418,537	532,043	18,348,077	746,608	22,175,846	831,018	21,237,603	831,162	25,510,643	974,184
Total sugar, molasses, and sirup	.....	2,970,894	.....	3,414,687	.....	3,783,971	.....	3,179,619	.....	3,361,611
Teazels	.....	23,459	.....	6,929	.....	5,012	.....	550	.....	2,056
Tobacco:										
Leaf.....pounds..	305,382,128	29,464,732	328,232,009	29,644,547	302,333,075	28,602,452	331,548,309	33,193,881	323,033,034	34,342,293
Stems and trimmings.....do....	6,589,703	176,080	6,070,082	156,269	9,894,127	205,915	9,194,555	183,517	7,779,624	384,864
Total.....do....	311,971,831	29,640,812	334,302,091	29,800,816	312,227,202	28,808,367	340,742,864	33,377,398	330,812,658	34,727,157
Vegetables:										
Fresh or dried—										
Beans and pease.....bushels..	248,805	546,479	330,321	730,922	447,474	960,710	435,490	932,264	306,939	708,201
Onions.....do....	144,764	116,104	234,048	209,938	205,102	182,060	257,747	217,582	174,820	184,166
Potatoes.....do....	484,042	436,135	1,163,270	750,210	1,000,326	743,993	1,530,461	1,278,034	1,203,894	1,077,612
Total fresh or dried.....do....	877,611	1,098,718	1,727,639	1,691,070	1,652,902	1,886,763	2,223,698	2,427,880	1,685,653	1,969,979
Prepared or preserved—										
Canned	.....	719,580	.....	580,048	.....	658,739	.....	598,628	.....	621,987
Other	.....	785,076	.....	929,742	.....	1,021,625	.....	981,325	.....	1,303,328
Total prepared or preserved	.....	1,504,656	.....	1,509,790	.....	1,680,364	.....	1,579,953	.....	1,925,315
Total vegetables	.....	2,603,374	.....	3,200,860	.....	3,567,127	.....	4,007,833	.....	3,895,294
Vinegar.....gallons..	132,450	19,192	111,994	17,158	92,027	16,266	81,752	13,274	109,263	15,841
Wines. (*See* Liquors, alcoholic.)										
Yeast	.....	18,772	.....	21,215	.....	23,099	.....	38,465	.....	37,658
Total vegetable matter, including forest products	.....	696,211,844	.....	666,103,329	.....	784,218,428	.....	892,555,792	.....	869,206,323
Total vegetable matter, excluding forest products	.....	626,126,055	.....	602,903,981	.....	707,242,997	.....	799,607,087	.....	778,844,250
Total agricultural exports, including forest products	.....	929,246,053	.....	890,104,125	.....	1,053,022,535	.....	1,147,354,121	.....	1,107,758,477
Total agricultural exports, excluding forest products	.....	859,160,264	.....	826,904,777	.....	976,047,104	.....	1,054,405,416	.....	1,017,396,404

Foreign trade of the United States in agricultural products, 1851–1908.

[Compiled from reports of Foreign Commerce and Navigation of the United States. All values are in gold.]

Year ending June 30—	Agricultural exports.			Agricultural imports.		Excess of domestic exports (+) or of net imports (−), agricultural.
	Domestic.		Foreign.	Total.	Percentage of all imports.	
	Total.	Percentage of all domestic exports.				
	Dollars.	*Per cent.*	*Dollars.*	*Dollars.*	*Per cent.*	*Dollars.*
1851	146,717,431	82.1	5,084,886	60,513,449	28.7	+ 91,288,868
1852	125,183,749	80.8	5,897,138	61,747,933	29.8	+ 69,332,954
1853	155,461,445	81.9	6,820,517	71,499,465	27.1	+ 90,782,497
1854	172,320,260	80.0	11,528,791	71,720,047	24.1	+112,129,004
1855	149,101,277	77.4	9,601,059	76,431,625	29.6	+ 82,270,711
1856	222,409,001	83.5	6,451,870	88,967,038	28.7	+139,893,833
1857	232,180,205	83.2	8,182,890	119,008,048	34.2	+121,355,047
1858	205,853,748	81.9	13,739,733	94,309,357	35.8	+125,284,124
1859	226,135,020	81.2	9,054,220	116,914,932	35.3	+118,274,308
1860	260,280,403	82.3	10,577,008	129,698,243	36.7	+141,159,168
1861	154,094,839	75.2	9,315,314	113,210,467	39.1	+ 50,199,686
1862	140,463,928	78.2	5,569,056	91,199,895	48.2	+ 54,833,089
1863	137,512,273	73.9	8,162,395	102,845,902	42.3	+ 42,828,766
1864	102,794,359	71.6	9,037,218	138,124,540	43.6	− 26,292,963
1865	84,886,860	62.0	17,876,028	113,969,772	47.7	− 11,206,884
1866	278,670,278	82.6	5,793,649	164,801,739	37.9	+119,662,188
1867	214,258,245	76.6	9,244,181	141,622,826	35.8	+ 81,879,600
1868	206,979,580	76.8	6,709,785	157,638,217	44.1	+ 56,051,148
1869	205,330,174	74.6	7,067,011	185,348,661	44.4	+ 27,048,524
1870	296,962,357	78.9	10,667,193	191,605,552	44.0	+116,023,998
1871	330,034,934	77.0	9,002,337	222,700,936	42.8	+116,336,335
1872	332,936,080	77.7	9,205,158	274,146,298	43.8	+ 67,994,940
1873	396,240,107	78.5	9,574,000	277,604,621	43.2	+128,209,486
1874	453,862,070	79.7	9,629,988	267,414,990	47.1	+196,077,068
1875	389,409,703	78.0	7,406,702	261,618,732	49.1	+135,197,673
1876	410,884,027	78.2	8,450,386	234,993,224	51.0	+184,341,189
1877	435,354,451	73.8	7,296,110	249,281,945	55.2	+193,368,616
1878	531,637,041	78.1	9,419,767	236,237,491	54.1	+304,819,317
1879	557,321,801	79.8	8,079,701	233,618,046	52.4	+331,783,456
1880	694,315,497	84.3	7,173,664	314,495,744	47.1	+386,993,417
1881	738,123,799	83.5	11,189,658	298,355,540	46.4	+450,957,917
1882	557,620,540	76.0	9,857,878	330,348,101	45.6	+237,130,317
1883	626,426,608	77.9	11,282,895	325,550,125	45.0	+312,159,378
1884	547,952,579	75.6	8,749,894	319,269,042	47.8	+237,433,431
1885	554,051,145	76.2	9,077,454	277,340,305	48.0	+285,788,294
1886	501,313,738	75.3	7,734,192	306,011,269	48.2	+203,036,661
1887	536,938,387	76.4	7,965,572	325,652,754	47.0	+219,251,205
1888	505,402,327	73.9	7,031,986	339,199,344	46.9	+173,234,969
1889	536,828,565	73.5	6,895,482	365,586,061	49.1	+178,137,986
1890	634,855,869	75.1	6,908,820	384,100,435	48.7	+257,664,254
1891	652,407,931	74.8	6,109,781	420,211,949	49.7	+238,305,763
1892	803,122,045	79.1	6,638,755	436,697,057	52.8	+373,063,743
1893	621,201,671	74.8	7,155,979	425,657,448	49.1	+202,700,202
1894	636,633,747	73.2	9,586,876	365,160,319	55.8	+281,060,304
1895	558,385,861	70.4	7,934,115	373,115,985	51.0	+193,203,991
1896	574,398,264	66.5	10,916,730	391,029,407	50.1	+194,285,587
1897	689,755,193	66.8	9,707,782	400,871,468	52.4	+298,591,507
1898	859,018,946	71.0	10,409,348	314,291,796	51.0	+555,136,498
1899	792,811,733	65.9	12,134,268	355,514,881	51.0	+449,431,120
1900	844,616,530	61.6	11,263,253	420,139,288	49.4	+435,740,495
1901	951,628,331	65.2	11,293,045	391,931,051	47.6	+570,990,325
1902	857,113,533	63.2	10,308,306	413,744,557	45.8	+453,677,282
1903	878,480,557	63.1	13,505,343	456,199,325	44.5	+435,786,575
1904	859,160,264	59.9	12,625,026	461,434,851	46.6	+410,350,439
1905	826,904,777	55.4	12,316,525	553,851,214	49.6	+285,370,088
1906	976,047,104	56.8	10,856,259	554,175,242	45.2	+432,728,121
1907	1,054,405,416	56.9	11,613,519	626,836,808	43.7	+439,182,127
1908	1,017,396,404	55.4	10,298,514	539,690,121	45.2	+488,004,797
Average:						
1851–1855	149,756,832	80.4	7,786,478	68,382,504	27.6	+ 89,160,806
1856–1860	229,371,675	82.4	9,601,144	109,779,524	34.2	+129,193,295
1861–1865	123,950,452	72.8	9,992,002	111,870,115	43.8	+ 22,072,339
1866–1870	240,440,127	78.1	7,896,364	168,203,399	41.2	+ 80,133,092
1871–1875	380,496,579	78.3	8,963,637	260,697,115	45.1	+128,763,101
1876–1880	525,902,563	79.2	8,083,926	253,725,290	51.5	+280,261,199
1881–1885	604,834,934	78.1	10,031,556	310,172,623	46.5	+304,693,867
1886–1890	543,067,777	74.8	7,307,210	344,109,973	48.0	+206,265,014
1891–1895	654,350,251	74.7	7,485,101	404,168,552	51.5	+257,666,800
1896–1900	752,120,133	66.2	10,886,276	376,369,368	50.8	+386,637,041
1901–1905	874,657,492	61.4	12,009,649	455,432,200	46.8	+431,234,941

Quantities of imports of selected agricultural products, 1851–1908.

[Compiled from reports of The Foreign Commerce and Navigation of the United States. Where figures are not given, either there were no imports or they were not separately classified for publication. "Silk" includes, prior to 1881, only "Silk, raw or as reeled from the cocoon;" in 1881 and 1882 are included this item and "Silk waste;" and after 1882, both these items and "Silk cocoons." From "Cocoa and chocolate" are omitted in 1860, 1861, and in 1872 to 1881, inclusive, small quantities of chocolate, the official returns for which were given in value but not in quantity. "Jute and jute butts" includes in 1858 and 1859 an unknown quantity of "Sisal grass, coir, etc.," and in 1865–1868 an unknown quantity of "Hemp." Cattle hides are included in "Hides and skins other than cattle and goat" in [illegible]. Olive oil for table use includes in 1862–1864 and 1885–1905 all olive oil. Sisal grass includes in 1884–1890 "Other vegetable substances." Hemp includes in 1885–1888 all substitutes for hemp.]

Year ending June 30—	Cheese.	Silk.	Wool.	Almonds.	Argols or wine lees.	Cocoa and chocolate, total.	Coffee.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1851	603,398		32,607,315	2,854,804		2,198,609	152,519,743
1852	514,337		18,343,218	1,564,703		1,372,341	193,906,353
1853	874,949		21,616,035	4,721,250		3,453,268	199,408,045
1854	969,417		20,282,635	2,187,934		3,162,072	162,255,993
1855	1,526,942		18,599,784	3,716,251		2,427,707	191,478,657
1856	1,384,272		14,778,496	5,113,897		2,017,471	235,865,268
1857	1,400,252		16,505,216	2,845,594		2,044,637	240,676,227
1858	1,589,066			2,210,941		1,810,449	189,211,300
1859	1,409,420			5,439,210		5,007,369	264,436,534
1860	1,401,161			2,873,014		3,186,721	202,144,733
1861	1,090,835			2,886,698	976,072	3,210,291	184,706,655
1862	594,822			918,360	866,404	3,541,364	122,799,311
1863	545,966			1,726,281	1,007,585	2,055,198	80,461,614
1864	836,127	407,935		3,964,875	1,597,790	2,940,571	131,622,782
1865	985,362			1,229,112	1,297,962	1,177,594	106,463,062
1866		567,904		4,571,687	2,004,996	2,550,978	181,413,192
1867	1,738,657	491,983		4,315,819	1,876,731	3,387,890	187,236,580
1868	2,997,944	512,449		1,461,007	1,822,498	3,211,976	248,983,900
1869		720,045	39,275,926		2,346,978	3,826,905	254,160,993
1870		583,589			2,591,472	3,640,845	235,256,574
1871		1,100,281			3,164,965	3,445,453	317,992,048
1872		1,063,809			4,942,601	4,917,809	298,805,946
1873		1,159,420	85,496,049		4,007,779	5,734,356	293,297,271
1874		794,837	42,939,541		3,246,376	3,661,992	285,171,512
1875		1,101,681	54,901,760		5,512,808	5,257,255	317,970,665
1876		1,354,991	44,642,836		7,047,802	4,715,406	339,789,246
1877		1,186,170	42,171,192		9,025,542	4,694,215	331,639,723
1878		1,182,750	48,449,079		10,257,909	4,780,339	309,882,540
1879		1,889,776	39,005,155		14,011,764	5,827,027	377,848,473
1880		2,562,236	128,131,747		14,445,534	7,508,130	446,850,727
1881		2,790,413	55,964,236		14,275,530	8,767,728	455,189,534
1882		3,221,269	67,861,744		18,320,366	11,091,123	459,922,768
1883		4,731,106	70,575,478		16,112,427	9,437,791	515,878,515
1884	6,243,014	4,284,888	78,350,651	3,828,104	19,591,039	12,739,871	534,785,542
1885	6,247,560	4,308,908	70,596,170	4,732,269	17,694,336	10,868,497	572,599,552
1886	6,309,124	6,818,060	129,084,958	5,822,733	16,041,666	13,703,583	564,707,533
1887	6,592,192	6,028,091	114,038,030	5,482,363	22,024,768	13,005,327	526,109,170
1888	8,750,185	6,370,322	113,558,753	5,747,957	17,226,491	17,502,929	423,645,794
1889	8,207,026	6,645,124	126,487,729	5,545,400	21,420,434	17,929,076	578,397,454
1890	9,263,573	7,510,440	105,431,285	5,715,858	24,908,054	19,894,130	499,159,120
1891	8,863,640	6,266,629	129,303,648	6,812,061	21,579,102	23,278,785	519,528,432
1892	8,305,288	8,834,049	148,670,652	7,629,392	24,813,171	23,712,261	640,210,788
1893	10,195,924	8,497,477	172,433,838	6,679,147	28,770,810	26,459,880	563,469,068
1894	8,742,851	5,902,485	55,152,585	7,436,784	22,373,180	19,899,393	550,934,337
1895	10,276,293	9,316,460	206,033,906	7,903,375	27,911,122	31,638,261	652,208,975
1896	10,728,397	9,363,987	230,911,473	7,789,681	28,481,665	25,666,373	580,597,915
1897	12,319,122	7,993,444	350,852,026	9,644,338	23,457,576	34,370,048	737,645,670
1898	10,012,188	12,087,951	132,795,202	5,746,362	19,202,629	27,525,513	870,514,455
1899	11,826,175	11,250,383	76,736,209	9,957,427	23,300,762	37,563,098	831,827,063
1900	13,455,990	13,073,718	155,928,455	6,317,633	27,339,489	43,968,252	787,991,911
1901	15,329,099	10,405,555	103,583,505	5,140,232	28,598,781	47,620,204	854,871,310
1902	17,067,714	14,234,826	166,576,966	9,868,982	29,276,148	52,878,587	1,091,004,252
1903	20,671,384	15,270,859	177,137,796	8,142,164	29,966,557	65,046,884	915,086,380
1904	22,707,103	16,722,709	173,742,834	9,838,852	24,571,730	75,070,746	995,043,284
1905	23,095,705	22,357,307	249,135,746	11,745,081	26,281,931	77,383,024	1,047,792,984
1906	27,286,866	17,352,021	201,688,668	15,009,326	28,140,835	84,127,027	851,668,933
1907	33,848,766	18,743,904	203,847,545	14,233,613	30,540,893	97,059,513	985,321,473
1908	32,530,830	16,662,132	125,980,524	17,144,968	26,738,834	6,604,684	890,640,057
Average:							
1851–1855	897,809		22,289,797	3,008,988		2,522,799	179,913,758
1856–1860	1,436,834			3,696,531		2,825,329	226,466,812
1861–1865	810,622			2,145,065	1,149,163	2,585,004	125,210,685
1866–1870		575,194			2,128,535	3,323,719	221,410,248
1871–1875		1,044,006			4,174,906	4,603,373	302,647,488
1876–1880		1,635,185	60,480,002		10,957,710	5,505,023	361,202,142
1881–1885		3,867,317	68,669,656		17,198,740	10,581,002	507,675,182
1886–1890	7,824,420	6,674,407	117,720,151	5,662,862	20,326,083	16,407,009	518,403,814
1891–1895	9,276,799	7,763,420	142,318,926	7,292,152	25,089,477	24,997,716	585,270,320
1896–1900	11,668,374	10,753,897	189,444,673	7,891,088	24,356,424	33,818,657	761,715,403
1901–1905	19,774,201	15,798,251	174,035,369	8,947,062	27,739,029	63,599,889	980,759,642

Quantities of imports of selected agricultural products, 1851–1908—Continued.

Year ending June 30—	Flax.	Hemp.	Hops.	Jute and jute butts.	Licorice root.	Manila.	Molasses.
	Tons.	*Tons.*	*Pounds.*	*Tons.*	*Pounds.*	*Tons.*	*Gallons.*
1851	1,059	1,876	....	1,919	....	9,917	36,376,772
1852	1,411	1,341	....	2,012	....	8,469	32,795,610
1853	678	2,621	....	1,269	....	12,510	31,886,100
1854	1,160	2,632	....	4,368	....	10,510	27,759,463
1855	1,448	961	....	4,665	607,596	14,254	26,385,593
1856	766	317	....	3,908	401,277	14,678	23,617,674
1857	1,112	3,082	....	5,589	1,099,073	17,668	32,705,844
1858	....	2,314	....	21,586	668,786	....	24,566,357
1859	....	3,378	....	22,538	903,161	....	32,818,146
1860	....	2,274	....	23,279	2,561,964	....	30,922,633
1861	....	2,211	....	13,203	1,539,882	6,366	29,941,397
1862	693	2,218	....	2,004	460,632	10,329	25,157,280
1863	1,594	732	....	2,592	1,173,034	13,961	30,854,264
1864	1,650	1,195	....	2,498	4,715,628	16,735	33,571,230
1865	....	1,627	3,837	2,990	793,197	13,948	36,445,906
1866	....	....	1,696,681	5,980	2,296,970	22,856	45,285,983
1867	1,571	3,193	865,016	7,809	3,034,255	15,273	56,123,079
1868	....	....	3,585,843	3,690	2,183,376	17,390	56,408,435
1869	1,953	18,731	....	17,549	....	....	53,304,030
1870	1,927	22,557	....	19,049	....	....	56,373,537
1871	3,672	20,805	....	26,450	....	....	44,401,350
1872	5,274	27,613	....	41,851	....	....	45,214,403
1873	4,171	20,573	....	63,329	....	....	43,533,909
1874	3,426	24,325	....	36,991	....	....	47,189,837
1875	4,322	23,063	....	43,402	....	....	49,112,255
1876	3,659	17,979	....	60,368	....	....	39,026,200
1877	4,498	17,128	....	50,793	....	....	30,327,825
1878	4,045	20,503	....	40,997	....	....	27,577,542
1879	2,935	17,711	....	69,590	....	....	38,460,347
1880	4,378	24,902	....	82,471	....	....	38,120,880
1881	5,446	32,044	497,243	68,631	....	....	28,708,221
1882	5,563	36,679	955,854	84,186	....	....	37,268,830
1883	5,748	29,063	2,122,589	125,318	....	....	33,228,276
1884	5,086	25,925	701,104	64,389	39,056,653	....	34,128,640
1885	6,435	32,463	1,642,086	98,343	26,406,008	....	31,392,893
1886	5,557	28,655	2,672,762	83,054	58,531,952	....	39,079,808
1887	7,140	32,739	18,538,049	88,514	79,603,835	....	38,007,700
1888	5,691	47,947	5,585,033	115,163	49,167,173	....	35,582,539
1889	7,896	55,835	4,176,158	88,655	57,068,600	....	27,024,551
1890	8,048	36,591	6,539,516	90,399	55,229,348	....	31,497,243
1891	6,331	11,484	4,019,603	141,704	55,307,911	35,331	20,604,463
1892	7,812	5,187	2,506,224	88,624	98,659,583	44,574	22,448,209
1893	6,696	4,817	2,691,244	82,231	93,002,250	59,439	15,490,679
1894	4,352	1,635	828,022	50,037	70,158,301	35,233	19,670,663
1895	7,233	6,954	3,133,664	110,671	83,281,275	50,278	15,075,879
1896	7,833	8,450	2,772,045	88,992	87,123,461	47,244	4,687,664
1897	9,190	5,120	3,017,821	68,550	62,370,337	46,260	3,702,471
1898	5,529	4,017	2,375,922	112,306	70,136,591	50,270	3,603,547
1899	6,474	3,941	1,319,319	83,161	98,432,319	53,195	5,821,556
1900	6,967	3,400	2,589,725	102,693	106,333,199	42,624	7,025,068
1901	6,878	4,057	2,606,708	103,140	100,105,654	43,735	11,453,156
1902	7,772	6,054	2,805,293	128,963	109,077,323	56,453	14,391,215
1903	8,155	4,919	6,012,510	79,703	88,580,611	61,648	17,240,399
1904	10,123	5,871	2,758,163	96,735	89,463,182	65,666	18,828,530
1905	8,089	3,987	4,339,379	98,215	108,443,892	61,562	19,477,885
1906	8,729	5,317	10,113,989	103,945	102,151,969	58,738	16,021,076
1907	8,656	8,718	6,211,983	104,489	66,115,863	54,513	24,630,935
1908	9,528	6,213	8,493,265	107,533	109,355,720	52,467	18,882,756
Average:							
1851–1855	1,151	1,886	....	2,847	....	11,132	31,040,708
1856–1860	....	2,273	....	15,380	1,144,852	....	28,926,131
1861–1865	....	1,597	....	4,657	1,736,475	12,268	31,194,015
1866–1870	....	....	....	10,815	....	....	53,499,013
1871–1875	4,173	23,276	....	42,405	....	....	45,890,353
1876–1880	3,903	19,645	....	60,844	....	....	34,702,559
1881–1885	5,656	31,235	1,183,775	88,173	....	....	32,945,372
1886–1890	6,866	40,353	7,502,304	93,157	59,920,182	....	34,238,368
1891–1895	6,485	6,015	2,635,751	94,653	80,081,864	44,971	18,657,979
1896–1900	7,199	4,986	2,414,966	91,140	84,879,181	47,919	4,968,061
1901–1905	8,203	4,978	3,704,411	101,351	99,134,132	57,813	16,278,237

Quantities of imports of selected agricultural products, 1851–1908—Continued.

Year ending June 30—	Olive oil, for table use	Opium, crude.	Potatoes.	Rice, and rice flour, rice meal, and broken rice.	Sisal grass.	Sugar, raw and refined.	Tea.
	Gallons.	*Pounds.*	*Bushels.*	*Pounds.*	*Tons.*	*Pounds.*	*Pounds.*
1851	....	40,885	299,132	....	....	380,402,289	17,461,114
1852	....	42,123	322,223	....	....	457,511,093	29,437,206
1853	....	131,370	353,082	....	....	464,392,286	22,721,745
1854	....	108,178	306,187	....	....	455,928,585	24,417,712
1855	....	111,229	516,241	....	....	473,809,847	25,333,097
1856	....	157,814	120,629	....	....	545,226,430	22,889,850
1857	....	131,154	109,771	....	....	776,984,262	20,367,824
1858	....	135,915		....	....	519,200,387	32,995,021
1859	....	71,839	....	....	....	655,846,362	29,268,757
1860	....	119,525	....	....	....	694,838,197	31,696,657
1861	....	109,536	753,511	....	....	809,749,958	26,419,956
1862	292,024	194,844	837,223	56,861,317	287	557,139,529	24,795,983
1863	173,561	62,618	327,315	61,196,740	567	522,122,085	29,761,037
1864	79,457	93,114	4,497	99,691,447	1,021	632,230,247	37,229,176
1865	87,860	110,790	10,955	60,407,756	332	651,038,818	19,568,318
1866	256,833	181,585	78,194	76,209,397	870	1,000,055,024	42,992,738
1867	124,497	135,305	198,265	44,782,223	864	849,054,006	39,892,658
1868	161,313	183,263	209,555	59,140,707	1,661	1,121,189,415	37,843,612
1869	176,687	157,182	138,470	53,065,191	....	1,247,833,430	43,754,354
1870	159,397	254,609	75,336	43,123,939	....	1,196,773,569	47,408,481
1871	142,243	315,121	458,758	64,655,827	....	1,277,473,653	51,364,919
1872	196,364	416,864	96,259	74,642,631	....	1,509,185,674	63,811,003
1873	182,818	319,134	346,840	83,755,225	....	1,568,304,592	64,815,136
1874	139,241	395,909	549,073	73,257,716	....	1,701,297,869	55,811,605
1875	176,119	305,136	188,757	59,414,749	....	1,797,509,990	64,856,899
1876	178,232	388,311	92,148	71,561,852	....	1,493,977,472	62,887,153
1877	194,069	349,223	3,205,555	64,013,064	....	1,654,556,831	58,347,112
1878	217,017	430,950	528,584	47,489,878	....	1,537,451,934	65,366,704
1879	192,326	405,957	2,624,149	75,824,923	....	1,834,365,836	60,194,673
1880	264,762	533,451	721,868	57,006,255	....	1,829,301,684	72,162,936
1881	224,362	318,700	2,170,372	68,739,409	....	1,946,865,165	81,843,988
1882	264,838	370,249	8,789,860	79,412,841	....	1,990,449,609	78,769,060
1883	257,375	457,499	2,362,362	96,673,080	....	2,137,819,123	73,479,164
1884	....	326,539	425,408	106,630,523	32,082	2,756,416,896	67,665,910
1885	493,928	334,169	658,633	119,074,577	36,897	2,717,884,653	72,104,956
1886	634,354	471,276	1,937,416	97,562,353	35,300	2,689,881,765	81,887,998
1887	744,766	568,263	1,432,490	103,950,359	36,355	3,136,443,240	89,831,221
1888	654,162	477,020	8,259,538	155,623,501	36,401	2,700,284,282	84,627,870
1889	893,338	391,563	883,380	186,376,560	38,542	2,762,202,967	79,575,984
1890	893,984	473,095	3,415,578	124,029,171	50,858	2,934,011,560	83,886,829
1891	605,509	466,554	5,401,912	214,363,582	39,213	3,483,477,222	83,453,339
1892	706,486	587,118	186,871	148,103,688	48,020	3,556,509,165	90,079,039
1893	686,852	615,957	4,317,021	147,483,828	54,431	3,766,445,347	89,061,287
1894	757,478	716,881	3,002,578	142,161,817	48,468	4,345,193,881	93,518,717
1895	775,046	358,455	1,341,533	219,564,320	47,596	3,574,510,454	97,253,458
1896	942,598	365,514	175,240	146,724,607	52,130	3,896,338,557	93,998,372
1897	928,567	1,072,914	246,178	197,816,134	63,266	4,918,905,733	113,347,175
1898	736,877	123,845	1,171,378	190,285,315	69,322	2,689,920,851	71,957,715
1899	930,042	513,499	530,420	204,177,293	71,898	3,980,250,769	74,089,899
1900	967,702	544,938	155,861	116,679,891	76,921	4,018,086,530	84,845,107
1901	983,059	583,208	371,911	117,199,710	70,076	3,975,005,840	89,806,453
1902	1,339,097	534,189	7,656,162	157,658,894	89,583	3,031,915,875	75,579,125
1903	1,494,132	516,570	358,505	169,656,284	87,025	4,216,108,106	108,574,905
1904	1,713,590	573,055	3,166,581	154,221,772	109,214	3,700,623,613	112,905,541
1905	1,923,174	594,680	181,199	106,483,515	100,301	3,680,932,998	102,706,599
1906	2,447,131	469,387	1,948,160	166,547,957	98,037	3,979,331,430	93,621,750
1907	3,449,517	565,252	176,917	209,603,180	99,061	4,391,839,975	86,368,490
1908	3,799,112	285,845	403,952	212,783,392	103,994	3,371,997,112	94,149,564
Average:							
1851–1855	....	86,757	359,373	....	....	446,408,820	23,874,175
1856–1860	....	123,249	....	....	....	638,419,128	27,443,622
1861–1865	....	114,180	386,700	....	....	634,576,127	27,554,894
1866–1870	175,745	182,389	139,964	55,264,291	....	1,082,981,089	42,378,369
1871–1875	167,357	350,433	327,937	71,145,230	....	1,570,754,356	60,131,912
1876–1880	209,281	421,578	1,434,461	63,179,194	....	1,669,930,751	63,791,716
1881–1885	....	361,431	2,881,327	94,106,086	....	2,309,887,089	74,772,616
1886–1890	764,121	476,243	3,185,680	133,508,389	39,491	2,844,564,763	83,961,980
1891–1895	706,274	548,993	2,849,983	174,335,447	47,546	3,745,227,214	90,673,168
1896–1900	901,157	524,142	455,815	171,136,648	66,707	3,900,700,488	87,647,654
1901–1905	1,490,610	560,340	2,346,872	141,044,035	91,240	3,720,917,286	97,914,525

Quantities of imports of selected agricultural products, 1851–1908—Continued.

Year ending June 30—	Beeswax.	Onions.	Plums and prunes.	Raisins.	Currants.	Dates.	Figs.
	Pounds.	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1883	168,879						
1884	48,123		60,600,228	53,702,220			7,945,977
1885	91,754		57,631,820	38,319,787			7,770,178
1886	26,546		64,995,545	40,387,946			7,223,070
1887	10,843		92,032,625	40,673,288			8,724,583
1888	51,702		70,626,027	40,476,763			10,058,053
1889	75,951		46,154,825	35,091,139			10,649,049
1890	126,319		58,093,410	36,914,330			10,284,998
1891	379,135		34,281,322	39,572,655	33,128,140	18,239,057	9,201,565
1892	271,068		10,869,797	20,687,640	36,665,828	17,084,557	8,338,759
1893	248,000		26,414,112	27,543,563	33,166,546	16,211,906	10,503,928
1894	318,660		9,908,122	13,751,050	52,664,843	12,408,192	7,985,959
1895	288,001		14,352,057	15,921,278	16,450,706	15,186,789	11,855,890
1896	273,464		483,658	10,826,094	33,040,846	13,680,302	11,900,710
1897	174,017	560,138	710,028	12,650,598	29,265,761	11,847,279	8,940,762
1898	272,097	488,853	303,992	6,593,833	25,186,210	13,561,434	9,628,426
1899	452,016	771,960	600,360	4,933,201	30,849,253	12,943,305	7,284,058
1900	213,813	546,798	443,457	10,309,498	36,251,779	19,902,512	8,812,487
1901	213,773	774,042	745,974	3,860,836	16,049,198	20,013,681	9,933,871
1902	408,706	796,316	522,478	6,683,545	36,238,976	21,681,159	11,087,131
1903	488,576	925,599	633,819	6,715,675	33,878,209	43,814,917	16,482,142
1904	425,168	1,171,242	494,105	6,867,617	38,347,649	21,058,164	13,178,061
1905	373,569	856,366	671,604	4,041,689	31,742,919	19,257,250	13,364,107
1906	587,617	872,566	497,494	12,414,855	37,078,311	22,435,672	17,562,358
1907	917,088	1,126,114	323,377	3,967,151	38,392,779	31,270,899	24,346,173
1908	671,526	1,275,333	335,089	9,132,353	38,652,656	24,958,343	18,836,574
Average:							
1886–1890	58,272		66,380,486	38,708,693			9,387,951
1891–1895	300,973		19,165,082	23,495,237	34,415,213	15,826,100	9,577,220
1896–1900	277,081		508,299	9,062,645	30,918,770	14,386,966	9,313,289
1901–1905	381,958	904,713	613,596	5,633,872	31,251,390	25,165,034	12,809,062

Year ending June 30—	Hides and skins, other than furs.			Macaroni, vermicelli, and all similar preparations.	Lemons.	Oranges.	Walnuts.
	Cattle.	Goat.	Other than cattle and goat.				
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1895		54,240,492	172,335,253				
1896		46,747,029	163,650,982				
1897		49,868,020	156,232,824				
1898	126,243,595	64,923,487	54,607,534				
1899	130,396,020	69,728,945	66,965,785				
1900	163,865,165	81,998,818	100,070,795		160,198,056	68,618,938	
1901	129,174,624	73,745,596	77,989,617		148,514,614	50,332,914	
1902	148,627,907	88,038,516	89,457,680		164,075,309	52,742,476	
1903	131,644,325	85,114,070	102,340,303	28,787,821	152,004,213	56,872,070	12,362,567
1904	85,370,168	86,338,547	103,024,752	40,224,202	171,923,221	35,893,260	23,670,761
1905	113,177,357	97,803,571	126,893,934	53,441,080	139,084,321	28,880,575	21,684,104
1906	156,155,300	111,079,391	158,045,419	77,926,029	138,717,252	31,134,341	24,917,028
1907	134,671,020	101,201,596	135,111,199	87,720,730	157,859,906	21,267,346	32,597,592
1908	98,353,249	63,640,758	120,770,918	97,233,708	178,490,003	18,397,429	28,887,110
Average:							
1896–1900		62,653,260	108,305,584				
1901–1905	121,598,876	86,208,060	99,941,257		155,120,336	44,944,259	

Quantities of exports of selected domestic agricultural products, 1851-1908.

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are not given, either there were no exports or they were not separately classified for publication. For "Beef, salted or pickled," and "Pork, salted or pickled," the barrels given in 1851-1865 were reduced to pounds at the rate of 200 pounds per barrel, and tierces in 1855-1865 were reduced at the rate of 300 pounds per tierce. It is assumed that 1 barrel of corn meal is the product of 4 bushels of corn, and that 1 barrel of wheat flour is the product of 5 bushels of wheat prior to 1880 and 4½ bushels of wheat for 1880 and subsequently.]

Year ending June 30—	Cattle.	Cheese.	Packing-house products.				
			Beef, cured—salted or pickled.	Beef, fresh.	Beef oils—oleo oil.	Beef (mostly)—tallow.	Beef and its products—total, as far as ascertainable, in pounds.[a]
	Number.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1851	1,350	10,361,189	18,129,600	...	...	8,198,278	26,327,878
1852	1,078	6,650,420	24,451,800	...	...	4,767,020	29,218,820
1853	1,076	3,763,932	25,208,200	...	...	3,926,598	29,134,798
1854	1,022	7,003,974	25,244,000	...	...	9,325,471	34,569,471
1855	1,501	4,846,568	29,560,800	...	...	11,866,992	41,427,792
1856	2,478	8,737,029	25,437,800	...	...	7,458,471	32,896,271
1857	4,325	6,453,072	15,668,000	...	...	5,698,315	21,366,315
1858	28,247	8,098,527	23,961,400	...	...	8,283,812	32,245,212
1859	32,513	7,103,323	30,801,000	...	...	7,103,045	37,904,045
1860	27,501	15,515,799	38,858,800	...	...	15,269,535	54,128,335
1861	8,885	32,361,428	25,640,200	...	...	29,718,364	55,358,564
1862	3,634	34,052,678	27,204,400	...	...	46,773,768	73,978,168
1863	5,509	42,045,054	29,259,800	...	...	63,792,754	93,052,554
1864	6,191	47,751,329	35,666,400	...	...	55,197,914	90,864,314
1865	9,589	53,154,318	27,129,200	...	...	30,884,500	58,013,700
1866	7,730	36,411,985	19,053,800	...	...	19,364,686	38,418,486
1867	10,221	52,352,127	14,182,562	...	...	23,296,931	37,479,493
1868	16,120	51,097,203	22,683,531	...	...	22,682,412	45,365,943
1869	...	39,960,367	27,299,197	...	...	20,534,628	47,833,825
1870	27,530	57,296,327	26,727,773	...	...	37,513,056	64,240,829
1871	20,530	63,698,867	43,880,217	...	...	33,859,317	77,739,534
1872	28,033	66,204,025	26,652,094	...	...	76,151,218	102,803,312
1873	35,455	80,366,540	31,605,196	...	...	79,170,558	110,775,754
1874	56,067	90,611,077	36,036,537	...	...	101,755,631	137,792,168
1875	57,211	101,010,853	48,243,251	...	...	65,461,619	113,704,870
1876	51,593	97,676,264	36,596,150	...	...	72,432,775	109,028,925
1877	50,001	107,364,666	39,155,153	49,210,990	...	91,472,803	179,838,943
1878	80,040	123,783,736	38,831,379	54,046,771	1,698,401	85,505,919	180,082,470
1879	136,720	141,654,474	36,950,563	54,025,832	12,687,318	99,963,752	203,627,465
1880	182,756	127,553,907	45,237,472	84,717,194	19,844,256	110,767,627	260,566,549
1881	185,707	147,995,614	40,698,649	106,004,812	26,327,676	96,403,372	269,434,509
1882	108,110	127,989,782	45,899,737	69,586,466	19,714,338	50,474,210	187,832,197
1883	104,444	99,220,467	41,680,623	81,064,373	29,031,064	38,810,098	192,536,459
1884	190,518	112,869,575	42,379,911	120,784,064	37,785,159	63,091,103	266,219,082
1885	135,890	111,992,990	48,143,711	115,780,830	37,120,217	50,431,719	252,810,842
1886	119,065	91,877,235	58,903,370	99,423,362	27,729,885	40,919,951	228,729,576
1887	106,459	81,255,994	36,287,188	83,560,874	45,712,985	63,278,403	272,916,803
1888	140,208	88,008,458	48,980,269	93,498,273	30,146,595	92,483,052	307,379,042
1889	205,786	84,999,828	55,006,399	137,895,391	28,102,534	77,844,555	352,260,216
1890	394,836	95,376,053	97,508,419	173,237,596	68,218,098	112,745,370	536,986,026
1891	374,679	82,133,876	90,286,979	194,045,638	80,231,035	111,689,251	589,447,206
1892	394,607	82,100,221	70,204,736	220,554,617	91,581,703	89,780,010	561,713,699
1893	287,094	81,350,923	58,423,963	206,294,724	113,939,363	61,819,153	523,944,938
1894	359,278	73,852,134	62,682,667	193,891,824	123,295,895	54,661,524	495,624,104
1895	331,722	60,448,421	62,473,325	191,338,487	78,098,878	25,864,300	432,799,823
1896	372,461	36,777,291	70,709,209	224,783,225	103,276,756	52,759,212	521,804,584
1897	392,190	50,944,617	67,712,940	290,395,930	113,506,152	75,108,834	606,547,427
1898	439,255	53,167,280	44,314,479	274,768,074	132,579,277	81,744,809	576,433,797
1899	389,490	38,198,753	46,564,876	282,139,974	142,390,492	107,361,009	623,970,458
1900	397,286	48,419,353	47,306,513	329,078,609	146,739,681	89,030,943	674,284,723
1901	459,218	39,813,517	55,312,632	351,748,333	161,651,413	77,166,889	705,104,772
1902	392,884	27,203,184	48,632,727	301,824,473	138,546,088	34,065,758	596,254,520
1903	402,178	18,987,178	52,801,220	254,795,963	126,010,339	27,368,924	546,055,244
1904	593,409	23,335,172	57,584,710	299,579,671	165,183,839	76,924,174	663,147,095
1905	567,806	10,134,424	55,934,705	236,486,568	145,228,245	63,536,992	575,874,718

[a] Includes beef, canned; beef, cured—salted or pickled; beef, cured—other; beef, fresh; oils—oleo oil; oleomargarin; tallow.

Quantities of exports of selected domestic agricultural products, 1851–1908—Continued.

Year ending June 30—	Cattle.	Cheese.	Packing-house products.				
			Beef, cured—salted or pickled.	Beef, fresh.	Beef, oils—oleo oil.	Beef (mostly)—tallow.	Beef and its products—total, as far as ascertainable in pounds.
	Number.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1906	584,239	16,562,451	81,088,098	268,054,227	209,658,075	97,567,156	732,884,572
1907	423,051	17,285,230	62,645,281	281,651,502	195,337,176	127,857,739	689,752,420
1908	349,210	8,430,031	46,958,367	201,154,105	212,541,157	91,397,507	579,303,478
Average:							
1851–1855	1,205	6,525,217	24,518,880	....	....	7,616,872	32,135,752
1856–1860	19,013	9,181,550	26,945,400	....	....	8,762,636	35,708,036
1861–1865	6,762	41,872,961	28,980,000	....	....	45,273,460	74,253,460
1866–1870	....	47,423,602	21,989,373	....	....	24,678,343	46,667,715
1871–1875	39,459	80,378,272	37,283,459	....	....	71,279,669	108,563,128
1876–1880	100,222	119,606,609	39,354,143	....	....	92,028,575	186,628,870
1881–1885	144,934	120,013,686	43,760,526	98,644,109	29,995,691	59,842,100	233,766,618
1886–1890	193,271	88,303,514	59,337,129	117,523,099	39,982,019	77,454,266	339,654,333
1891–1895	349,476	75,977,115	68,814,334	201,225,058	97,429,375	68,762,848	520,705,954
1896–1900	398,136	45,501,459	55,321,603	280,233,162	127,698,472	81,200,961	600,608,198
1901–1905	483,099	23,894,695	54,053,199	288,887,002	147,323,985	55,812,547	617,287,270

Year ending June 30—	Packing-house products—Continued.					Apples, fresh.	Corn and corn meal (converted to corn).
	Pork, cured—bacon.	Pork, cured—hams.	Pork, cured—salted or pickled.	Pork—lard.	Pork and its products—total, as far as ascertainable in pounds.[a]		
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Barrels.*	*Bushels.*
1851	18,027,302	....	33,041,200	19,683,082	70,751,584	28,842	4,241,299
1852	5,746,816	....	16,676,400	21,281,951	43,705,167	18,411	3,351,495
1853	18,390,027	....	25,976,200	24,435,014	68,801,241	45,075	3,123,381
1854	45,953,473	....	44,029,400	44,450,154	134,433,027	15,326	8,798,428
1855	38,188,989	....	59,752,000	39,025,492	136,966,481	33,959	8,876,417
1856	41,748,092	....	56,279,000	37,582,271	135,609,363	74,287	11,466,708
1857	43,863,539	....	28,902,600	40,246,544	113,012,683	33,201	8,575,334
1858	20,954,374	....	31,975,000	33,022,286	85,951,660	27,711	5,716,693
1859	11,989,694	....	41,148,400	28,362,706	81,500,800	32,979	2,755,538
1860	25,844,610	....	40,948,600	40,289,519	107,082,729	78,809	4,248,991
1861	50,264,267	....	31,297,400	47,908,911	129,470,578	112,523	11,491,496
1862	141,212,786	....	61,820,400	118,573,307	321,606,493	66,767	19,919,178
1863	218,243,609	....	65,570,400	155,336,596	439,150,605	174,502	17,151,268
1864	110,886,446	....	63,519,400	97,190,765	271,596,611	183,969	5,146,122
1865	46,053,034	....	41,786,800	44,480,136	132,319,970	120,317	3,616,653
1866	37,588,930	....	30,056,788	30,110,451	97,756,169	51,612	14,465,751
1867	25,648,226	....	27,374,877	45,608,031	98,631,134	29,577	16,026,947
1868	43,659,064	....	28,690,133	64,555,462	136,904,659	19,874	12,493,522
1869	49,228,165	....	24,439,832	41,887,545	115,555,542	....	8,286,665
1870	38,968,256	....	24,639,831	35,808,530	99,416,617	38,157	2,140,487
1871	71,446,854	....	39,250,750	80,037,297	190,734,901	49,088	10,673,553
1872	246,208,143	....	57,169,518	199,651,660	503,029,321	36,508	35,727,010
1873	395,381,737	....	64,147,461	230,534,207	690,063,405	241,663	40,154,374
1874	347,405,405	....	70,482,379	205,527,471	623,415,255	44,928	35,985,834
1875	250,286,549	....	56,152,331	166,869,393	473,308,273	276,209	30,025,036
1876	327,730,172	....	54,195,118	168,405,839	550,331,129	64,472	50,910,532
1877	460,057,146	....	69,671,894	234,741,233	764,470,273	417,065	72,652,611
1878	592,814,351	....	71,889,255	342,766,254	1,007,469,860	101,617	87,192,110
1879	732,249,576	....	84,401,676	326,658,686	1,143,309,938	505,018	87,884,892
1880	759,773,109	....	95,949,780	374,979,286	1,230,702,175	407,911	99,572,329
1881	673,274,361	73,670,184	107,928,086	378,142,496	1,233,015,127	1,117,065	93,648,147
1882	428,481,482	39,545,158	80,447,466	250,367,740	798,841,846	176,704	44,340,683
1883	294,118,759	46,139,911	62,116,302	224,718,474	627,093,446	313,921	41,655,653
1884	341,579,410	47,919,958	60,363,313	265,094,719	715,142,817	105,400	46,258,606
1885	345,924,217	54,202,902	71,649,365	283,216,339	755,416,926	668,867	52,876,456

[a] Includes lard; pork, canned; pork, cured—bacon pork, cured—hams; pork, cured—salted or pickled; pork, fresh.

Quantities of exports of selected domestic agricultural products, 1851–1908—Cont'd.

Year ending June 30—	Packing-house products—Continued.					Apples, fresh.	Corn and corn meal (converted corn).
	Pork, cured—bacon.	Pork, cured—hams.	Pork, cured—salted or pickled.	Pork—lard.	Pork and its products—total, as far as ascertainable in pounds.		
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Barrels.*	*Bushels.*
1886	369,423,351	50,365,445	87,196,966	293,728,019	800,784,530	744,539	64,829,617
1887	364,417,744	55,505,211	85,869,367	321,533,746	827,349,998	591,868	41,368,584
1888	331,306,703	44,132,980	58,836,966	297,740,007	732,079,843	489,570	25,360,869
1889	357,377,399	42,847,247	64,110,845	318,242,990	782,601,275	942,406	70,841,673
1890	531,899,677	76,591,279	79,788,868	471,083,598	1,159,642,885	453,506	103,418,709
1891	514,675,557	84,410,108	81,317,364	498,343,927	1,179,565,831	135,207	32,041,529
1892	507,919,830	76,856,559	80,336,481	460,045,776	1,125,536,392	938,743	76,602,285
1893	391,758,175	82,178,154	52,459,722	365,693,501	893,002,196	408,014	47,121,894
1894	416,657,577	86,970,571	63,575,881	447,566,867	1,015,939,543	78,580	66,489,529
1895	452,549,976	105,494,123	58,266,893	474,895,274	1,092,024,847	818,711	28,585,405
1896	425,352,187	129,036,351	69,498,373	509,534,256	1,134,165,823	360,002	101,100,375
1897	500,399,448	165,247,302	66,768,920	568,315,640	1,302,037,734	1,503,981	178,817,417
1898	650,108,933	200,185,861	88,133,078	709,344,045	1,659,996,202	605,390	212,055,543
1899	562,651,480	225,846,750	137,197,200	711,259,851	1,678,265,645	380,222	177,255,046
1900	512,153,729	196,414,412	133,199,683	661,813,663	1,538,024,466	526,636	213,123,412
1901	456,122,741	216,571,803	138,643,611	611,357,514	1,462,369,849	883,673	181,405,473
1902	383,150,624	227,653,232	115,896,275	556,840,222	1,337,315,909	459,719	28,028,688
1903	207,336,000	214,183,365	95,287,374	490,755,821	1,042,119,570	1,656,129	76,639,261
1904	249,665,941	194,948,864	112,224,861	561,302,643	1,146,255,441	2,018,262	58,222,061
1905	262,246,635	203,458,724	118,887,189	610,238,899	1,220,031,970	1,499,942	90,293,483
1906	361,210,563	194,267,949	141,820,720	741,516,886	1,464,960,356	1,208,989	119,893,833
1907	250,418,699	209,481,496	166,427,409	627,559,660	1,268,065,412	1,539,267	86,368,228
1908	241,189,929	221,769,634	149,505,937	603,413,770	1,237,210,760	1,049,545	55,063,860
Average:							
1851–1855	25,261,321	....	35,895,040	29,775,139	90,931,500	28,323	5,678,204
1856–1860	28,880,062	....	39,850,720	35,900,665	104,631,447	49,397	6,552,653
1861–1865	113,332,028	....	52,798,880	92,697,943	258,828,851	131,616	11,464,943
1866–1870	39,018,528	....	27,040,292	43,594,004	109,652,824	....	10,682,674
1871–1875	262,145,738	....	57,440,488	176,524,006	496,110,231	129,679	30,513,161
1876–1880	574,524,871	....	75,221,545	289,510,260	939,256,675	299,217	79,642,495
1881–1885	416,675,646	52,295,623	76,500,906	280,307,954	825,902,032	476,391	55,755,909
1886–1890	390,884,975	53,888,432	75,160,602	340,465,672	860,491,706	644,378	61,163,890
1891–1895	456,712,223	87,181,903	67,191,268	449,309,069	1,061,213,762	475,851	50,168,128
1896–1900	530,133,155	183,346,135	98,959,451	632,053,491	1,462,497,974	675,246	176,470,359
1901–1905	311,704,388	211,363,198	116,187,862	566,099,020	1,241,618,548	1,303,545	86,917,793

Year ending June 30—	Hops.	Oils, vegetable—cotton-seed oil.	Rice and rice bran, meal and polish.	Sugar, raw and refined.	Wheat.	Wheat flour.	Wheat and wheat flour (converted to wheat).
	Pounds.	*Gallons.*	*Pounds.*	*Pounds.*	*Bushels.*	*Barrels.*	*Bushels.*
1851	110,360	....	63,354,000	3,251,369	1,026,725	2,202,335	12,038,400
1852	238,008	....	71,839,800	2,498,390	2,694,540	2,799,339	16,691,235
1853	245,647	....	40,624,200	5,827,331	3,890,141	2,920,918	18,494,731
1854	260,026	....	63,072,600	9,893,751	8,036,665	4,022,386	28,148,595
1855	4,021,816	....	39,421,600	11,160,945	798,884	1,204,540	6,821,584
1856	1,048,515	....	67,616,000	9,271,191	8,154,877	3,510,626	25,708,007
1857	924,538	....	68,322,800	5,338,247	14,570,331	3,712,053	33,130,596
1858	458,889	....	58,122,200	7,201,120	8,926,196	3,512,169	26,487,041
1859	587,953	....	77,070,400	6,558,757	3,002,016	2,431,824	15,161,136
1860	273,257	....	81,632,600	4,466,031	4,155,153	2,611,596	17,213,133
1861	8,835,837	....	43,512,400	6,511,134	31,238,057	4,323,756	52,856,837
1862	4,860,046	....	4,221,600	2,755,252	37,289,572	4,882,033	61,699,737
1863	8,864,081	....	1,694,800	3,595,009	36,160,414	4,390,055	58,110,689
1864	5,851,165	....	2,176,800	2,328,483	23,681,712	3,557,347	41,468,447
1865	3,671,371	....	983 200	1,900,002	9,937,876	2,641,298	23,144,366
1866	349,987	....	2,212,901	4,460,138	5,579,103	2,183,050	16,494,353
1867	1,001,603	....	1,394,007	8,130,175	6,146,411	1,300,106	12,646,941
1868	532,038	....	3,079,043	2,218,150	15,940,899	2,076,423	26,323,014
1869	11,269,555	....	2,232,833	3,167,523	17,557,836	2,431,873	29,717,201
1870	16,356,231	....	2,133,014	4,427,576	36,584,115	3,463,333	53,900,780

Quantities of exports of selected domestic agricultural products, 1851-1908—Cont'd.

Year ending June 30—	Hops.	Oils, vegetable—cottonseed oil.	Rice and rice bran, meal and polish.	Sugar, raw and refined.	Wheat.	Wheat flour.	Wheat and wheat flour (converted to wheat).
	Pounds.	*Gallons.*	*Pounds.*	*Pounds.*	*Bushels.*	*Barrels.*	*Bushels.*
1871	3,273,653	....	445,842	3,841,078	34,304,906	3,653,841	52,574,111
1872	3,061,244	547,165	403,835	4,478,492	26,423,080	2,514,535	38,995,755
1873	1,795,437	709,576	276,637	10,083,363	39,204,285	2,562,086	52,014,715
1874	117,358	782,067	558,922	10,132,911	71,039,928	4,094,094	91,510,398
1875	3,066,703	417,387	277,337	24,152,388	53,047,177	3,973,128	72,912,817
1876	9,191,589	281,054	439,991	51,863,691	55,073,122	3,935,512	74,750,682
1877	9,581,108	1,705,422	1,306,982	39,751,324	40,325,611	3,343,665	57,043,936
1878	18,458,782	4,992,349	631,105	44,093,092	72,404,961	3,947,333	92,141,626
1879	5,458,159	5,352,530	740,136	72,352,964	122,353,936	5,629,714	150,502,506
1880	9,739,566	6,997,796	183,534	30,142,004	153,252,795	6,011,419	180,304,181
1881	8,990,655	3,444,084	150,451	22,252,833	150,565,477	7,945,786	186,321,514
1882	5,867,363	713,549	143,289	13,814,005	95,271,802	5,915,686	121,892,389
1883	7,817,228	415,611	136,143	28,542,115	106,385,828	9,205 664	147,811,316
1884	13,516,643	3,605,946	163,519	76,122,813	70,349,012	9,152,260	111,534,182
1885	7,055,289	6,364,279	663,502	252,740,427	84,653,714	10,648,145	132,570,366
1886	13,665,661	6,240,139	1,700,576	164,429,490	57,759,209	8,179,241	94,565,793
1887	260,721	4,067,138	4,126,630	190,804,677	101,971,949	11,518,449	153,804,969
1888	6,793,818	4,458,597	1,858,735	34,646,157	65,789,261	11,963,574	119,625,344
1889	12,589,262	2,690,700	2,890,027	14,259,414	46,414,129	9,374,803	88,600,743
1890	7,540,854	13,384,385	3,681,979	27,225,469	54,387,767	12,231,711	109,430,467
1891	8,736,080	11,003,160	3,490,895	108,433,474	55,131,948	11,344,304	106,181,316
1892	12,604,686	13,859,278	10,256,796	14,850,391	157,280,351	15,196,769	225,665,811
1893	11,367,030	9,462,074	13,711,798	20,746,327	117,121,109	16,620,339	191,912,635
1894	17,472,975	14,958,309	10,766,249	15,468,496	88,415,230	16,859,533	164,283,129
1895	17,523,388	21,187,728	1,623,336	9,529,008	76,102,704	15,268,892	144,812,718
1896	16,765,254	19,445,848	15,031,554	9,402,524	60,650,080	14,620,864	126,443,968
1897	11,426,241	27,198,882	3,905,754	8,305,219	79,562,020	14,569,545	145,124,972
1898	17,161,669	40,230,784	6,200,987	6,508,290	148,231,261	15,349,943	217,306,005
1899	21,145,512	50,627,219	15,334,689	9,865,347	139,432,815	18,485,690	222,618,420
1900	12,639,474	46,902,390	41,066,417	22,514,603	101,950,389	18,699,194	186,096,762
1901	14,963,676	49,356,741	25,527,846	8,874,860	132,060,667	18,650,979	215,990,073
1902	10,715,151	33,042,848	29,591,274	7,572,452	154,856,102	17,759,203	234,772,516
1903	7,794,705	35,642,994	19,750,448	10,520,156	114,181,420	19,716,484	202,905,598
1904	10,985,988	29,013,743	29,121,763	15,418,537	44,230,169	16,999,432	120,727,613
1905	14,858,612	51,535,580	113,282,760	18,348,077	4,394,402	8,826,335	44,112,910
1906	13,026,904	43,793,519	38,142,103	22,175,846	34,973,291	13,919,048	97,609,007
1907	16,809,534	41,880,304	30,174,371	21,237,603	76,569,423	15,584,667	146,700,425
1908	22,920,480	41,019,991	28,444,415	25,510,643	100,371,057	13,927,247	163,043,669
Average:							
1851-1855	975,171	....	55,662,440	6,526,357	3,289,391	2,629,904	16,438,909
1856-1860	658-630	....	70,552,800	6,567,069	7,761,715	3,155,654	23,539,985
1861-1865	6,416,500	....	10,517,760	3,417,976	27,661,526	3,958,898	47,456,016
1866-1870	5,901,883	....	2,210,360	4,480,712	16,361,673	2,290,957	27,816,458
1871-1875	2,262,879	....	392,515	10,537,646	44,803,875	3,359,537	61,601,560
1876-1880	10,485,841	3,865,830	660,350	47,640,615	88,682,085	4,573,529	110,948,586
1881-1885	8,649,436	2,908,694	251,381	78,694,439	101,445,167	8,573,508	140,025,953
1886-1890	8,170,063	6,168,192	2,851,589	86,273,041	65,264,463	10,653,556	113,205,463
1891-1895	13,540,832	14,094,110	7,969,815	33,805,539	98,810,268	15,057,967	166,571,122
1896-1900	15,827,630	36,881,025	16,307,880	11,319,197	105,965,313	16,345,047	179,518,025
1901-1905	11,863,626	39,718,381	43,454,818	12,146,816	89,944,552	16,390,487	163,701,742

Foreign trade in forest products, 1851–1908.

[Compiled from reports of Foreign Commerce and Navigation of the United States. All values in gold.]

Year ending June 30—	Exports of forest products.		Imports of forest products.	Excess of domestic exports (+) or of net imports (−).
	Domestic.	Foreign.		
1851	$4,188,635	$566,554	$1,332,522	+$3,422,667
1852	4,400,741	411,166	1,133,785	+ 3,678,122
1853	4,704,394	341,566	1,244,991	+ 3,800,969
1854	8,636,443	470,483	1,881,492	+ 7,225,434
1855	8,879,743	1,320,670	4,824,649	+ 5,375,764
1856	7,474,074	926,299	3,562,539	+ 4,837,834
1857	10,411,894	1,164,280	3,606,262	+ 7,969,912
1858	10,579,417	1,295,768	3,521,211	+ 8,353,974
1859	11,396,163	747,621	3,387,124	+ 8,756,660
1860	10,299,959	846,929	8,086,735	+ 3,060,153
1861	7,286,605	756,112	7,734,540	+ 308,177
1862	6,468,911	808,273	5,982,091	+ 1,295,093
1863	6,544,788	872,515	7,849,625	− 432,322
1864	6,701,909	616,086	10,401,691	− 3,083,696
1865	7,444,439	1,109,049	7,688,145	+ 865,343
1866	9,579,561	584,459	11,635,299	− 1,471,279
1867	11,297,881	599,918	12,975,903	− 1,078,104
1868	12,162,538	674,786	12,586,964	+ 250,360
1869	11,654,909	361,480	6,073,805	+ 5,942,584
1870	12,209,323	1,181,708	7,873,631	+ 5,517,400
1871	12,133,380	635,847	16,510,455	− 3,741,228
1872	16,741,148	1,004,495	19,402,210	− 1,656,567
1873	19,811,877	774,909	24,452,286	− 3,865,500
1874	21,443,549	1,116,763	21,468,824	+ 1,091,488
1875	17,118,463	1,019,887	17,295,187	+ 843,163
1876	15,954,288	883,254	16,023,785	+ 813,757
1877	18,549,676	532,547	15,386,709	+ 3,695,514
1878	17,335,741	705,941	16,331,795	+ 1,709,887
1879	16,270,593	557,434	18,745,076	− 1,917,049
1880	17,056,870	614,399	27,847,871	−10,176,602
1881	19,324,096	352,249	31,707,280	−12,030,935
1882	25,580,254	1,321,446	36,962,880	−10,061,180
1883	28,645,199	2,137,165	36,623,551	− 5,841,187
1884	26,222,959	1,450,032	35,843,883	− 8,170,892
1885	22,014,839	1,125,404	28,702,940	− 5,562,697
1886	21,061,708	1,052,083	32,042,431	− 9,928,640
1887	21,126,152	1,567,996	34,704,566	−12,009,418
1888	23,991,092	1,319,270	39,861,356	−14,550,994
1889	26,997,602	1,767,853	36,887,715	− 8,122,260
1890	29,473,084	1,337,677	40,010,518	− 9,199,757
1891	28,715,713	1,220,002	46,772,282	−16,836,567
1892	27,957,928	1,542,639	47,052,892	−17,552,325
1893	28,127,281	1,178,837	49,720,275	−20,414,157
1894	28,001,461	1,973,803	39,683,781	− 9,708,517
1895	28,576,680	1,277,705	43,302,134	−13,447,749
1896	33,718,790	2,563,550	45,696,324	− 9,413,984
1897	40,490,428	3,242,262	44,791,463	− 1,058,773
1898	38,439,418	2,582,082	45,751,938	− 4,730,438
1899	42,828,732	3,011,832	53,317,266	− 7,476,702
1900	52,676,575	3,981,002	60,633,078	− 3,975,501
1901	55,369,161	3,599,192	57,143,650	+ 1,824,703
1902	48,928,764	3,609,071	59,187,049	− 6,649,214
1903	58,734,016	2,865,325	71,478,022	− 9,878,681
1904	70,085,789	4,177,352	79,619,296	− 5,356,155
1905	63,199,348	3,790,097	92,680,555	−25,691,110
1906	76,975,431	4,809,261	96,462,364	−14,677,672
1907	92,948,705	5,500,331	122,420,776	−23,971,740
1908	90,362,073	4,570,397	97,733,092	− 2,800,622
Average:				
1851–1855	6,161,991	622,088	2,083,488	+ 4,700,591
1856–1860	10,032,301	996,179	4,432,774	+ 6,595,706
1861–1865	6,889,330	832,407	7,931,218	− 209,481
1866–1870	11,380,842	680,470	10,229,120	+ 1,832,192
1871–1875	17,449,683	910,380	19,825,792	− 1,465,729
1876–1880	17,033,434	658,715	18,867,047	− 1,174,898
1881–1885	24,357,469	1,277,259	33,968,107	− 8,333,379
1886–1890	24,529,928	1,408,976	36,701,317	−10,762,413
1891–1895	28,275,813	1,438,597	45,306,273	−15,591,863
1896–1900	41,630,789	3,076,146	50,038,014	− 5,331,079
1901–1905	59,263,416	3,608,207	72,021,714	− 9,150,091

Quantities of exports of selected domestic forest products, 1851–1908.

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are not given, either there were no exports or they were not separately classified for publication.]

Year ending June 30—	Lumber.			Rosin.	Spirits of turpentine.	Timber.	
	Boards, deals, and planks.[a]	Shooks, other than box.	Staves.			Hewn.	Sawed.
	M feet.	*Number.*	*Number.*	*Barrels.*	*Gallons.*	*Cubic feet.*	*M feet.*
1851	100,604			387,220	363,828		
1852	100,695			449,194	358,658		
1853	78,599			454,715	634,371		
1854	197,154			601,280	1,669,523		
1855	144,718			731,060	2,339,138		
1856	126,330			524,799	1,844,560		
1857	309,165			641,517	1,522,177		
1858	217,861			574,573	2,457,235		
1859	197,099			798,083	2,682,230		
1860	170,922			770,652	4,072,023		
1861	132,332			536,207	2,941,855		
1862	129,243			65,441	43,507		
1863	135,901			17,025	58,565		
1864	132,298	1,019,340		2,418	32,548		
1865	172,644	1,043,797		11,232	51,863		
1866	120,013			250,452	349,325		
1867	131,666			334,104	1,513,225		
1868	131,873			443,501	3,068,629		
1869	134,370			585,989	3,184,955		
1870	140,863			583,316	3,246,697	7,115,975	
1871	154,830			511,959	2,453,554	7,115,007	
1872	176,872			692,728	4,495,441	12,594,738	
1873	236,557			845,162	5,114,653	14,154,244	
1874	228,481			929,342		25,209,048	
1875	213,974			937,527	5,599,624	13,553,714	
1876	252,407			824,256		21,786,414	
1877	321,530				6,796,927	20,640,259	
1878	313,143			1,042,183	7,633,568	18,361,915	
1879	275,102			1,112,816	7,575,556	13,255,241	
1880	285,194			1,040,345	7,091,200	16,365,346	
1831	320,602			1,023,710	6,595,528	22,961,618	
1882	407,455			1,156,012	8,136,493	24,491,354	
1833	499,406			1,347,256	9,867,344	19,913,220	
1884	414,920	1,275,450		1,545,211	11,300,729	10,615,065	201,257
1885	412,424	1,281,571		1,269,304	8,987,226	8,411,066	153,248
1886	435,608	1,098,347		1,131,560	8,217,678	5,077,612	193,344
1887	424,760	902,269		1,365,012	10,209,883	4,260,639	167,609
1888	436,718	668,972		1,492,314	10,585,942	5,813,175	187,780
1889	571,075	543,597		1,420,218	9,681,759	6,301,065	252,996
1890	612,814	534,190		1,601,377	11,248,920	8,732,761	270,984
1891	613,406	316,242		1,790,251	12,243,621	6,900,073	214,612
1892	592,596	412,308		1,950,214	13,176,470	6,736,446	235,550
1893	629,355	385,863		2,059,407	13,415,459	7,836,921	214,198
1894	574,920	383,706		1,987,128	12,618,407	4,082,709	237,830
1895	588,781	352,928		1,862,394	14,652,738	6,039,539	297,693
1896	694,799	643,099		2,172,991	17,431,566	5,616,476	332,934
1897	876,689	695,858		2,429,116	17,302,823	6,406,824	391,291
1898	790,659	544,079	54,142,759	2,206,203	18,351,140	5,489,714	338,575
1899	970,170	616,380	44,382,689	2,563,229	17,761,533	4,796,658	406,448
1900	1,046,758	773,019	49,011,533	2,369,118	18,090,582	4,416,741	473,542
1901	1,101,815	714,651	47,363,262	2,820,815	20,240,851	4,624,698	533,920
1902	942,814	788,241	46,998,512	2,535,962	19,177,788	5,388,439	412,750
1903	1,065,771	566,205	55,879,010	2,396,498	16,378,787	3,291,498	530,659
1904	1,426,784	533,182	47,420,095	2,585,108	17,202,808	3,788,740	558,690
1905	1,283,406	872,192	48,286,285	2,310,275	15,894,813	3,856,623	486,411
1906	1,343,607	1,066,253	57,586,378	2,438,556	15,981,253	3,517,046	552,548
1907	1,623,964	803,346	51,120,171	2,560,966	15,854,676	3,278,110	600,865
1908	1,548,130	900,812	61,696,949	2,712,732	19,532,583	4,883,506	463,440

[a] Including "Joists and scantling" prior to 1884.

Quantities of exports of selected domestic forest products, 1851–1908—Continued.

Year ending June 30—	Lumber.			Rosin.	Spirits of turpentine.	Timber.	
	Boards, deals, and planks.[a]	Shooks, other than box.	Staves.			Hewn.	Sawed.
	M feet.	*Number.*	*Number.*	*Barrels.*	*Gallons.*	*Cubic feet.*	*M feet.*
Average:							
1851–1855	124,354	....	....	524,694	1,073,104	....	....
1856–1860	204,275	....	....	661,925	2,515,645	....	....
1861–1865	140,484	....	....	126,465	625,668	....	....
1866–1870	131,757	....	....	439,472	2,272,566	....	....
1871–1875	202,143	....	....	783,344	....	14,525,350	....
1876–1880	289,475	....	....	....	....	18,081,835	....
1881–1885	410,961	....	....	1,268,299	8,977,464	17,278,465	....
1886–1890	496,195	749,475	....	1,402,096	9,988,836	6,037,050	214,543
1891–1895	599,812	370,209	....	1,929,879	13,221,339	6,319,138	239,977
1896–1900	875,815	654,487	....	2,348,131	17,787,529	5,345,283	388,558
1901–1905	1,164,118	694,894	49,189,433	2,529,732	17,779,009	4,190,000	504,486

Quantities of imports of selected forest products, 1851–1908.

[Compiled from reports of Foreign Commerce and Navigation of the United States. Where figures are not given, either there were no imports or they were not separately classified for publication.]

Year ending June 30—	Camphor, crude.	India rubber.	Rubber gums, total.	Lumber.		Shellac.	Wood pulp
				Boards, deals, planks, and other sawed.	Shingles.		
	Pounds.	*Pounds.*	*Pounds.*	*M feet.*	*M.*	*Pounds.*	*Tons.*
1851	176,226	....	....	....	....	....	....
1852	189,316	....	....	....	....	....	....
1853	109,908	....	....	....	....	....	....
1854	233,496	....	....	....	....	....	....
1855	193,909	....	....	....	....	....	....
1856	341,972	....	....	....	....	....	....
1857	389,568	....	....	....	....	....	....
1858	706,999	....	....	....	....	....	....
1859	612,263	....	....	....	....	....	....
1860	49,047	....	....	....	....	....	....
1861	44,734	....	....	....	....	....	....
1862	298,097	2,125,561	2,458,821	....	....	131,974	....
1863	221,280	5,104,650	5,128,026	....	....	615,036	....
1864	517,570	....	....	333	....	789,510	....
1865	177,756	....	....	....	....	531,081	....
1866	718,953	....	[a] 36,855	108,439	....	1,103,777	....
1867	432,075	....	[a] 42,262	413,375	....	784,365	....
1868	2,005	8,438,019	8,438,019	255,843	....	548,227	....
1869	....	....	7,813,134	....	....	....	....
1870	....	....	9,624,098	....	....	....	....
1871	....	....	11,031,939	725,994	....	....	....
1872	....	....	11,803,437	714,731	102,904	....	....
1873	1,117,930	....	14,536,978	818,302	108,448	....	....
1874	780,737	....	14,191,320	562,395	109,245	....	....
1875	947,191	....	12,035,909	393,786	82,110	....	....
1876	322,972	....	10,589,297	333,996	38,279	....	....
1877	1,022,565	....	13,821,109	316,271	34,190	....	....
1878	1,117,290	....	12,512,203	327,298	47,532	....	....
1879	982,580	....	14,878,584	355,304	48,710	....	....
1880	2,445,471	....	16,826,099	515,343	59,402	....	....
1881	2,010,165	....	20,015,176	575,320	....	87,135	....
1882	2,076,192	....	22,712,862	612,364	99,264	....	589
1883	2,312,166	....	21,646,320	572,099	104,657	....	....
1884	2,047,732	....	24,574,025	600,762	86,219	2,865,753	7,491
1885	2,223,038	....	24,208,148	555,582	69,511	3,468,891	13,523

[a] Gutta-percha only.

Quantities of imports of selected forest products, 1851–1908—Continued.

Year ending June 30—	Camphor, crude.	India rubber.	Rubber gums, total.	Lumber.		Shellac.	Wood pulp.
				Boards, deals, planks, and other sawed.	Shingles.		
	Pounds.	*Pounds.*	*Pounds.*	*M feet.*	*M.*	*Pounds.*	*Tons.*
1886	1,133,913	....	29,263,632	547,832	79,150	4,396,431	10,139
1887	2,857,222	....	28,649,446	559,236	89,169	4,722,538	23,410
1888	2,779,719	....	36,628,351	608,743	161,715	4,206,850	35,133
1889	1,961,018	....	32,339,503	648,174	214,546	5,509,873	40,917
1890	2,055,287	....	33,842,374	660,327	194,168	4,739,465	43,478
1891	1,716,167	33,712,089	34,672,924	757,244	260,652	6,253,380	43,316
1892	1,955,787	39,976,205	40,284,444	663,253	363,027	6,310,266	41,118
1893	1,733,425	41,547,680	42,130,058	742,597	459,044	5,604,732	63,565
1894	1,323,932	33,757,783	34,256,546	514,619	378,632	4,868,681	35,587
1895	1,500,739	39,741,607	41,068,401	600,798	51,513	6,401,060	28,440
1896	945,629	36,774,460	40,618,314	786,209	....	6,056,957	45,143
1897	1,469,601	35,574,449	36,692,114	883,781	....	7,151,459	41,770
1898	2,047,234	46,055,497	46,691,974	353,215	435,421	6,984,395	29,846
1899	1,807,889	51,063,066	58,055,887	423,928	471,594	9,830,111	33,319
1900	1,789,580	49,377,138	58,506,569	680,226	541,040	10,621,451	82,441
1901	2,175,784	55,275,529	64,927,176	490,820	555,853	9,608,745	46,757
1902	1,831,058	50,413,481	67,790,069	665,603	707,614	9,064,789	67,416
1903	2,472,440	55,010,571	69,311,678	720,937	724,131	11,590,725	116,881
1904	2,819,673	59,015,551	74,327,584	589,232	770,373	10,933,413	144,796
1905	1,904,002	67,234,256	87,004,384	710,538	758,725	10,700,817	167,504
1906	1,668,744	57,844,345	81,109,451	949,717	900,856	15,780,090	157,224
1907	3,138,070	76,963,838	107,935,185	934,195	881,003	17,785,960	213,110
1908	2,814,299	62,233,160	87,334,026	791,288	988,081	13,361,932	237,514
Average:							
1851–1855	180,571	....	....	....	....	....	....
1856–1860	419,970	....	....	....	....	....	....
1861–1865	251,887	....	....	....	....	....	....
1866–1870	....	....	5,190,874	....	....	....	....
1871–1875	....	....	12,719,917	643,042	....	....	....
1876–1880	1,178,176	....	13,725,458	369,642	45,623	....	....
1881–1885	2,133,859	....	22,631,306	583,225	89,357	....	....
1886–1890	2,157,432	....	32,144,661	604,862	147,750	4,715,031	30,615
1891–1895	1,646,010	37,747,073	38,482,475	655,702	302,574	5,887,624	42,405
1896–1900	1,611,987	43,768,922	48,112,972	625,472	....	8,128,875	46,504
1901–1905	2,240,591	57,389,878	72,672,178	635,426	703,339	10,379,698	108,671

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